VOLUME LVIII NUMBER THREE

THE NATIONAL GEOGRAPHIC MAGAZINE

SEPTEMBER, 1930

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TO carry out the purposes for which it was founded forty-two years ago the National Geographic Society publishes this Magazine monthly. All receipts are invested in the Magazine itself or expended directly to promote geographic knowledge.

ARTICLES and photographs are desired. For material which the Magazine can use, generous remuneration is made. Contributions should be accompanied by addressed return envelope and postage.

IMMEDIATELY after the terrific eruption of the world's largest crater, Mt. Katmai, in Alaska, a National Geographic Society expedition was sent to make observations of this remarkable phenomenon. Four expeditions have followed and the extraordinary scientific data resulting given to the world. In this vicinity an eighth wonder of the world was discovered and explored—"The Valley of Ten Thousand Smokes," a vast area of steaming, spouting fissures. As a result of The Society's discoveries this area has been created a National Monument by proclamation of the President of the United States.

AT an expense of over $50,000 The Society sent a notable series of expeditions into Peru to investigate the traces of the Inca race. Their discoveries form a large share of our knowledge of a civilization waning when Pizarro first set foot in Peru.

THE Society also had the honor of subscribing a substantial sum to the expedition of Admiral Peary, who discovered the North Pole, and contributed $55,000 to Admiral Byrd's Antarctic Expedition.

NOT long ago The Society granted $25,000, and in addition $75,000 was given by individual members to the Government when the congressional appropriation for the purpose was insufficient, and the finest of the giant sequoia trees of California were thereby saved for the American people.

THE Society's notable expeditions to New Mexico have pushed back the historic horizons of the Southwestern United States to a period nearly eight centuries before Columbus crossed the Atlantic. By dating the ruins of the vast communal dwellings in that region The Society's researches have solved secrets that have puzzled historians for three hundred years. The Society is sponsoring an ornithological survey of Venezuela.

TO further the study of solar radiation in relation to long range weather forecastings, The Society has appropriated $65,000 to enable the Smithsonian Institution to establish a station for six years on Mt. Brukkaros, in South West Africa.

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arrives first at the directors' meeting?

THE first to arrive is the one man privileged to waste others' time. But he seldom does. The president is generally in his chair on the very stroke of the hour.

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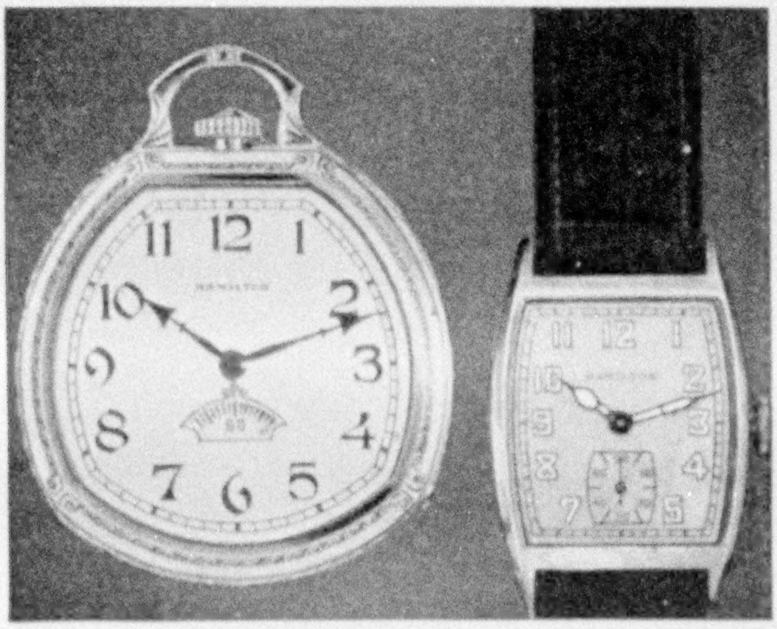

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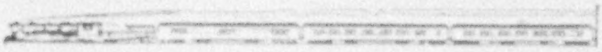

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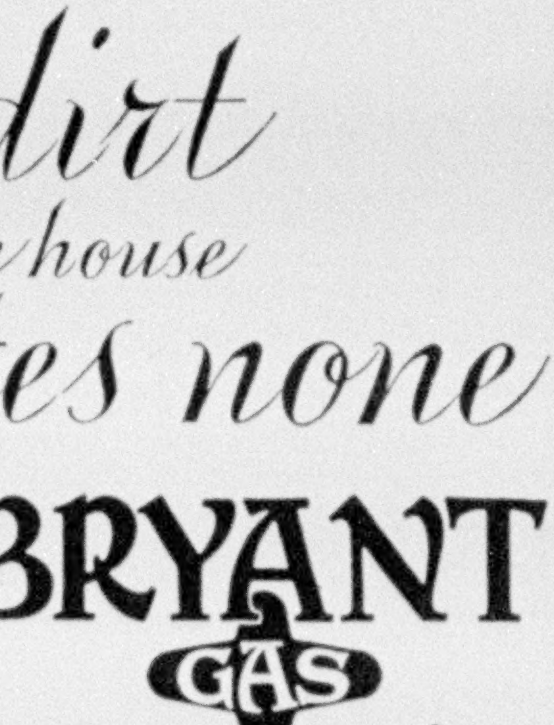

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With John entering College

. . . And Mary in High School

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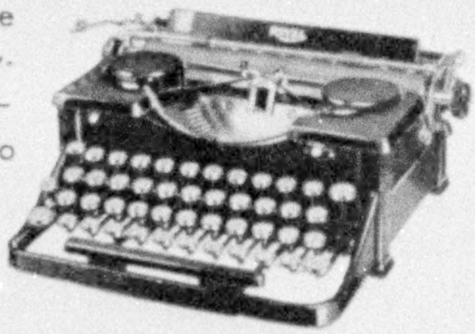

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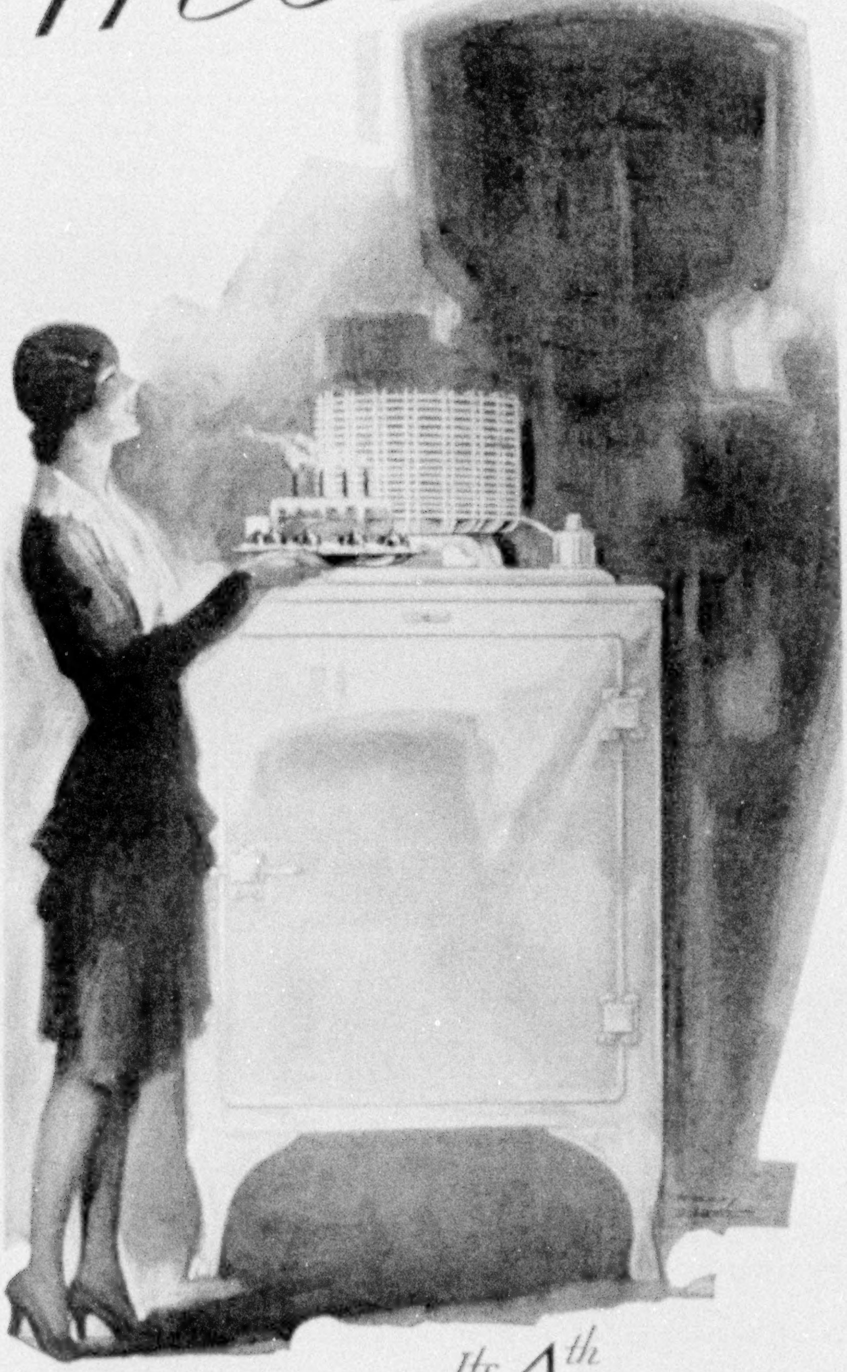

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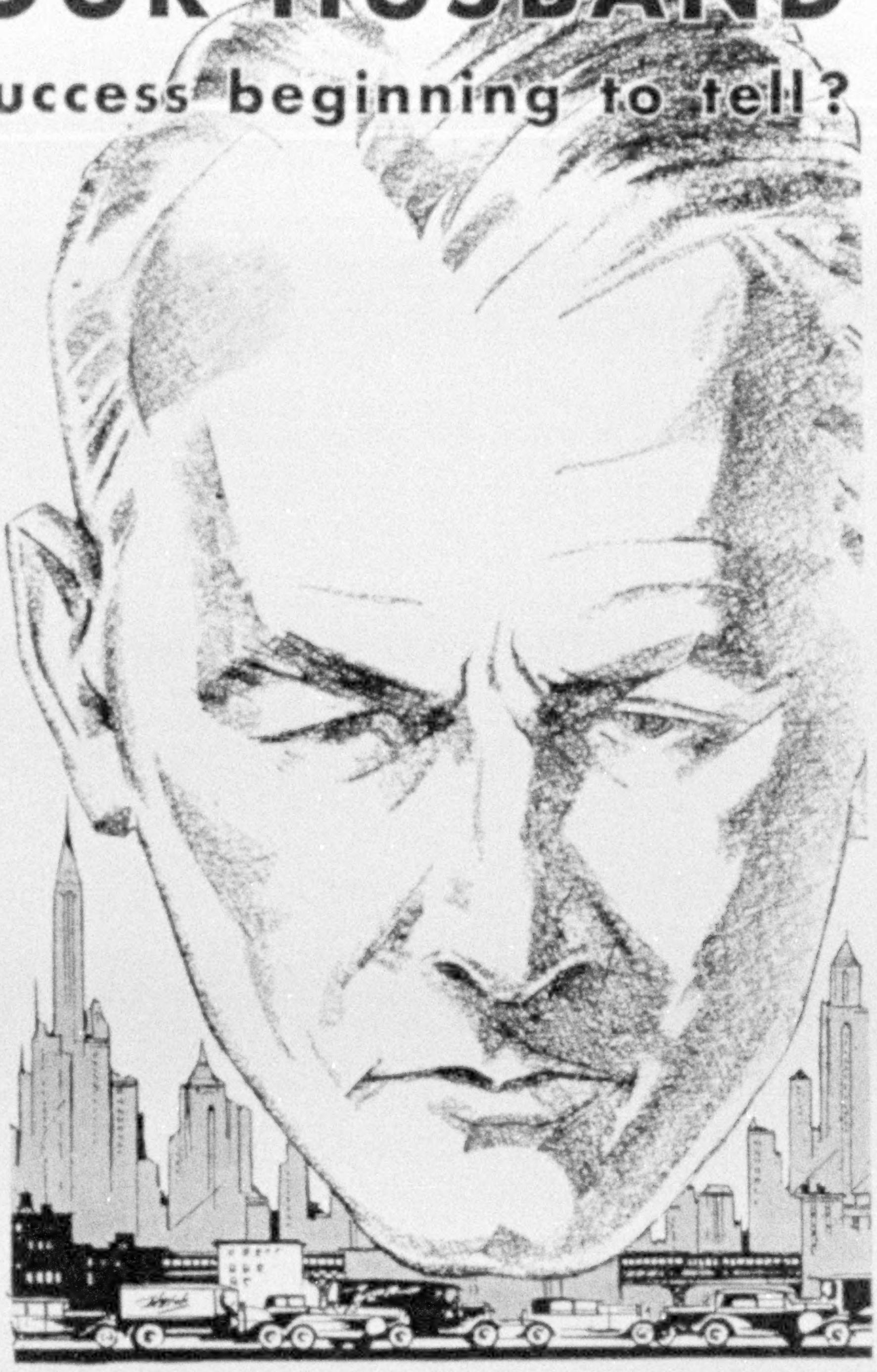

The path to achievement is lined with the headstones of men who *couldn't stop work*. Earnest, unselfish martyrs to the modern fetish of material success.

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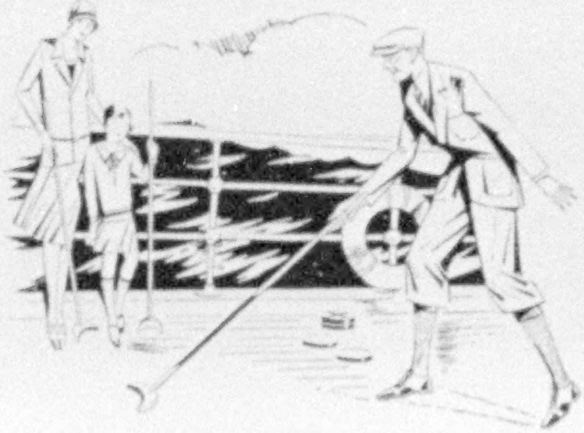

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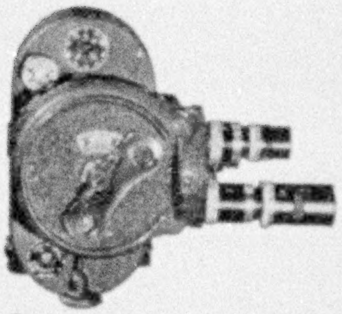

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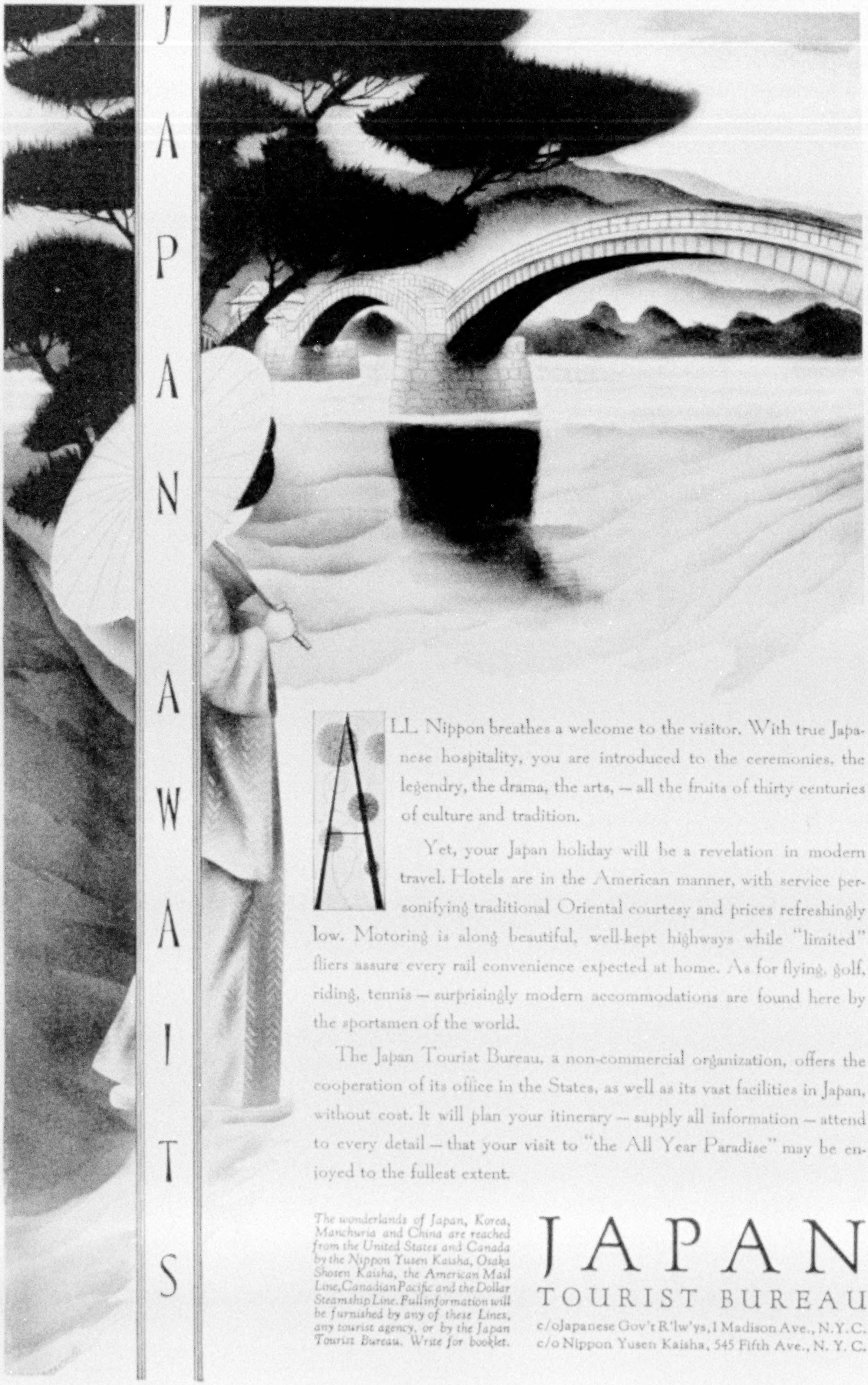

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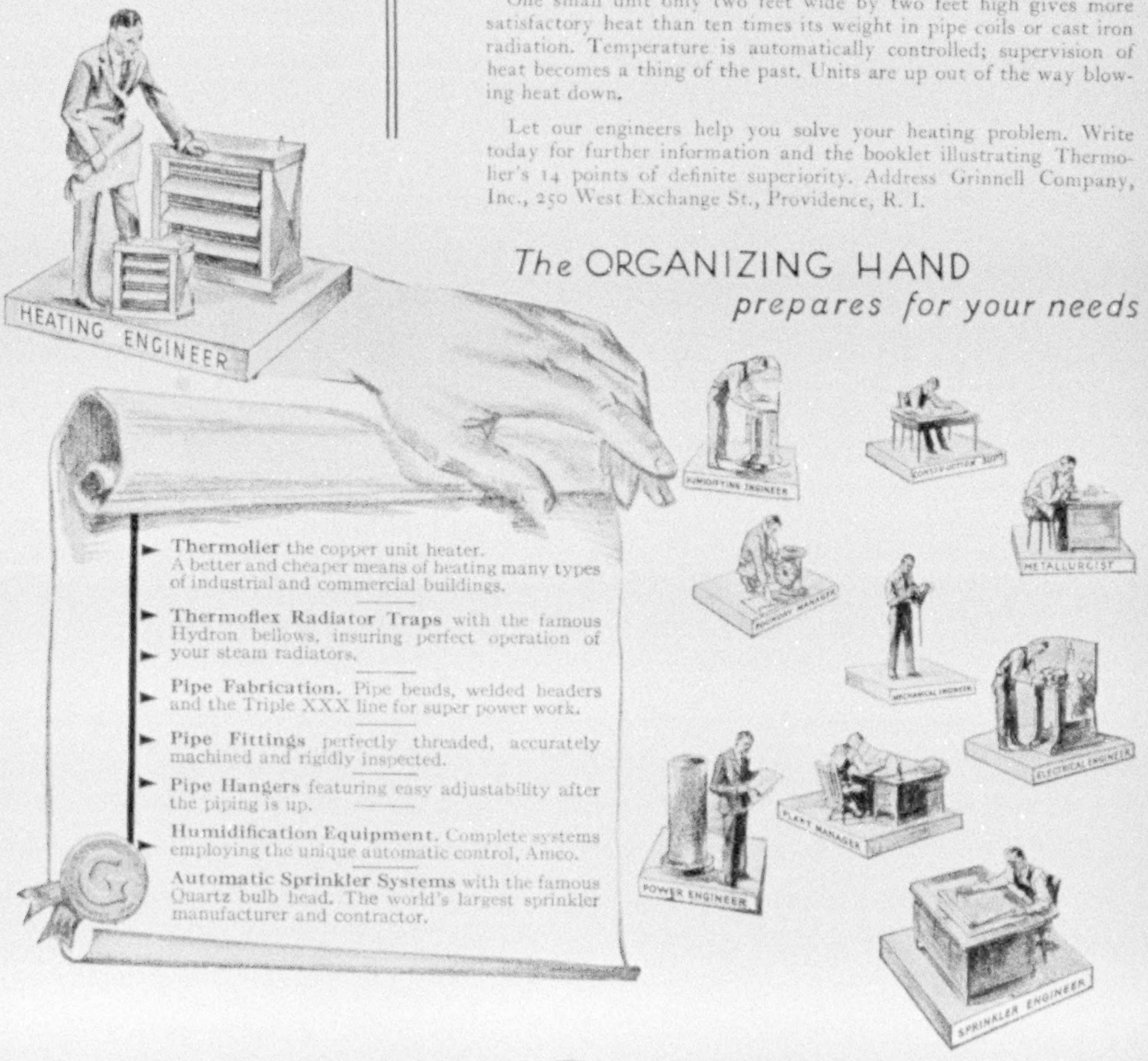

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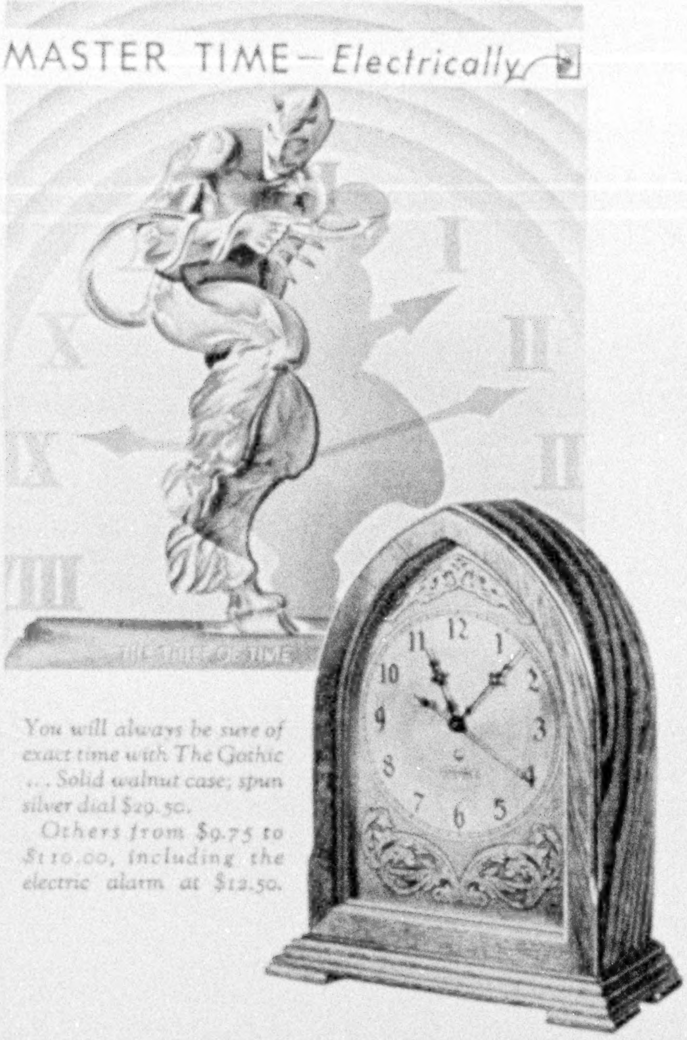

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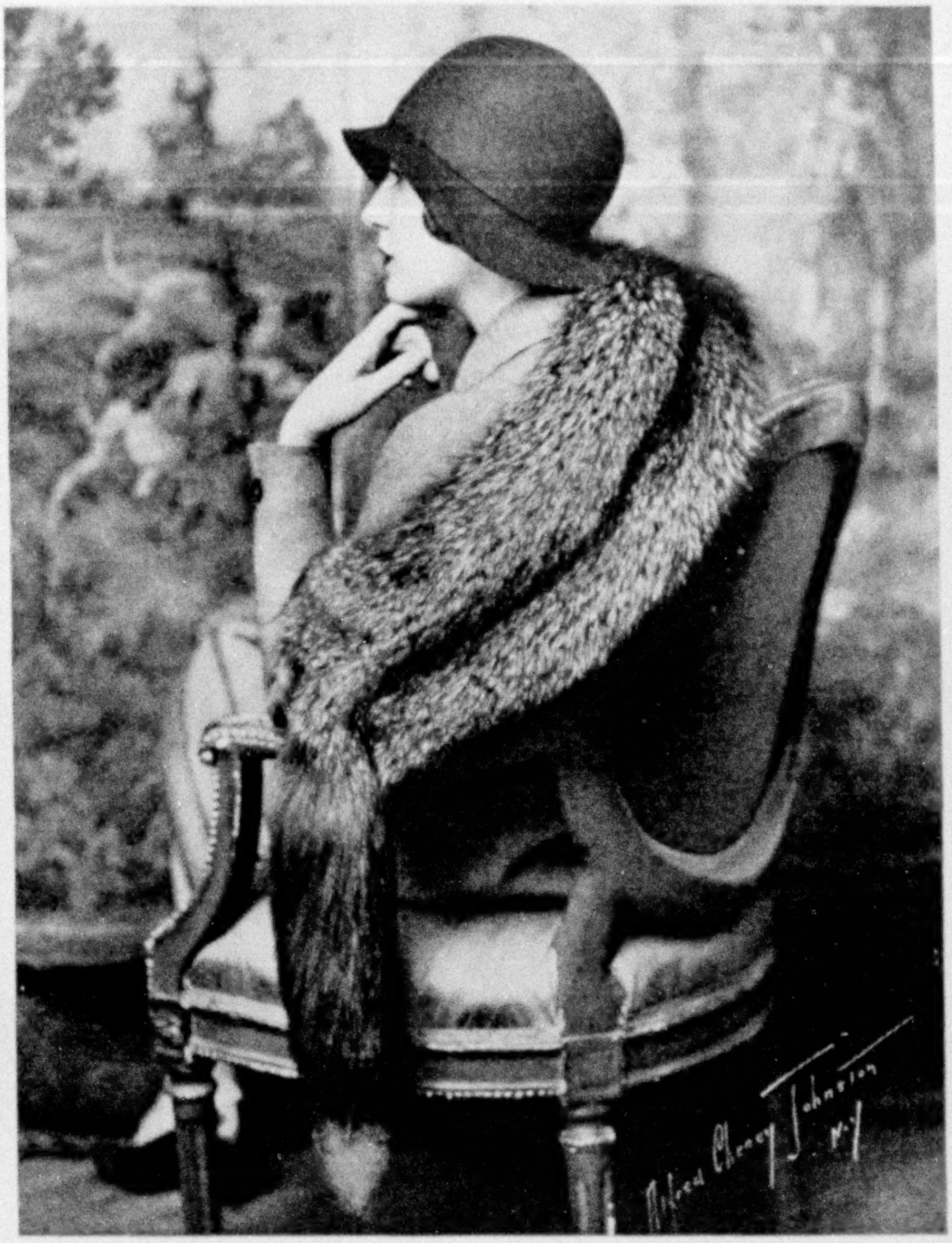
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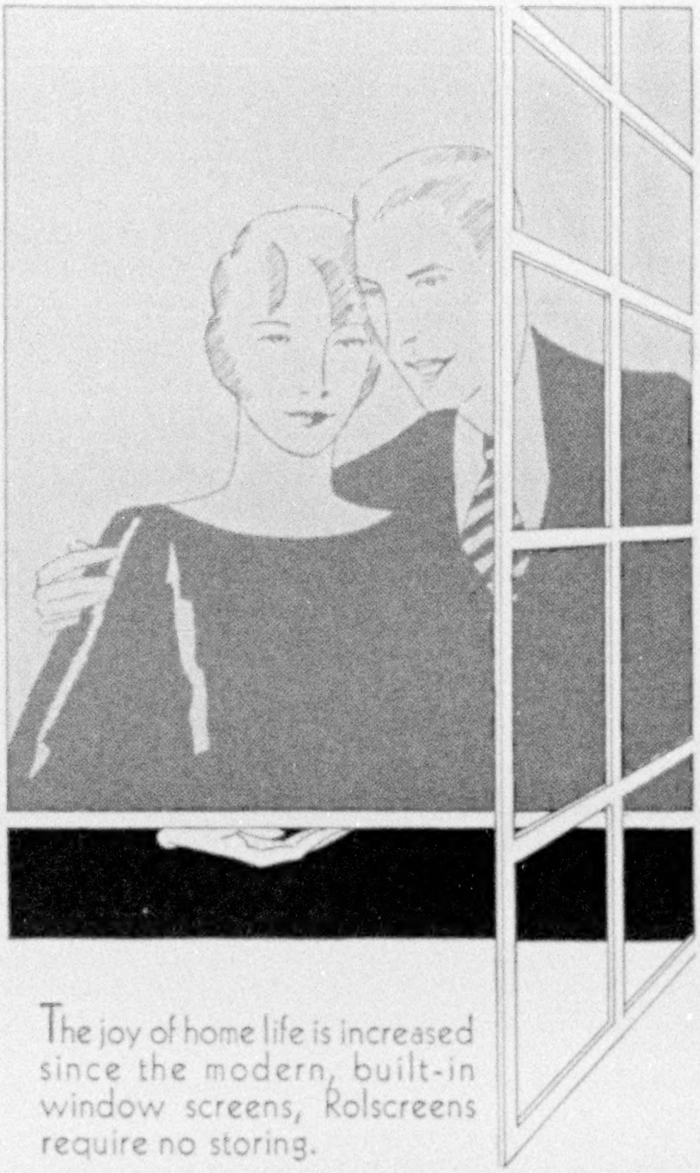

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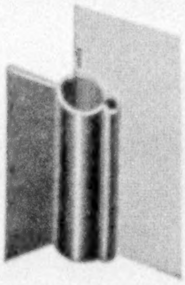

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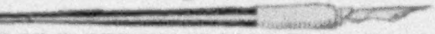

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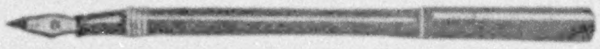

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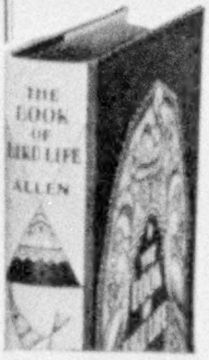

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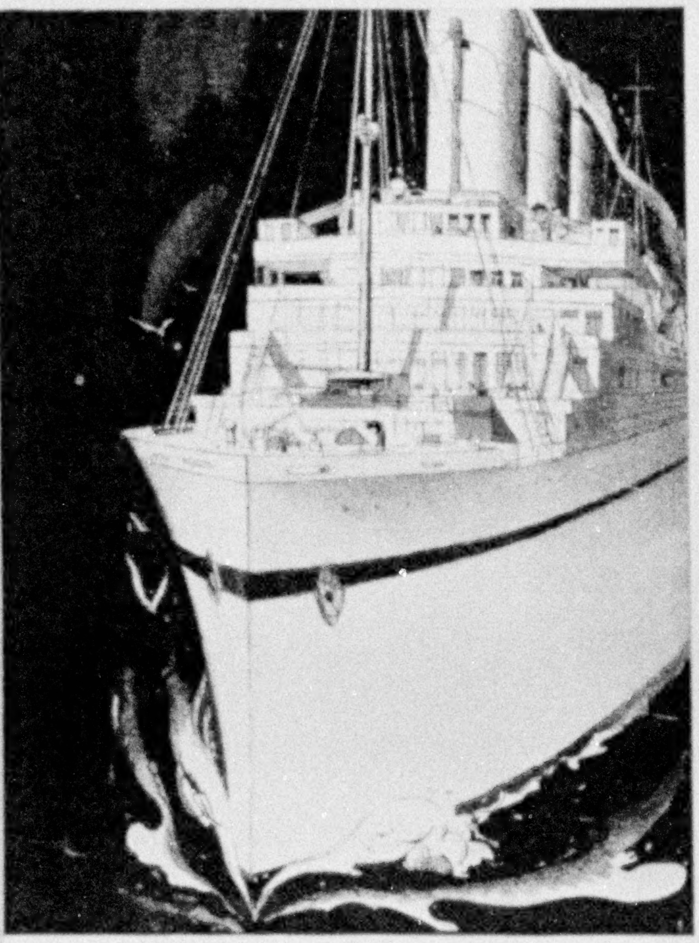

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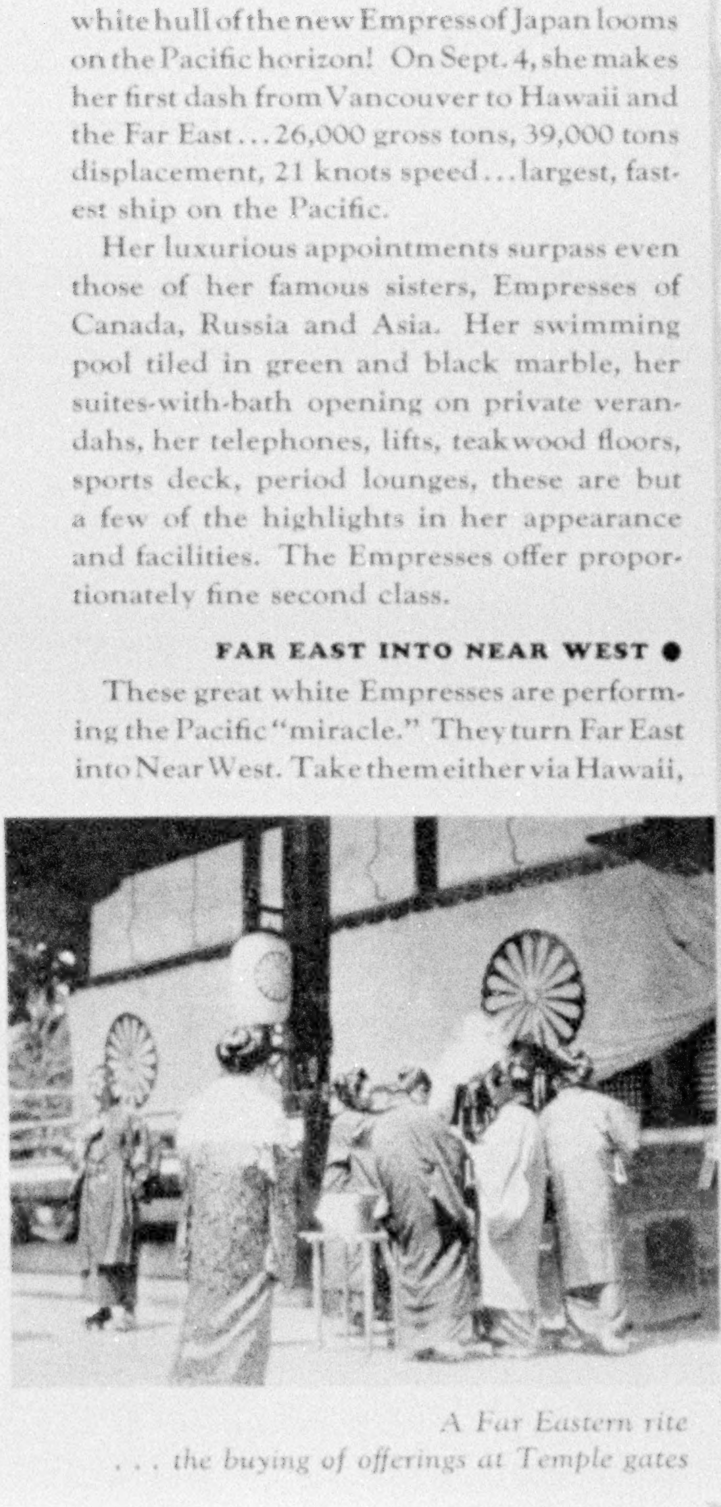

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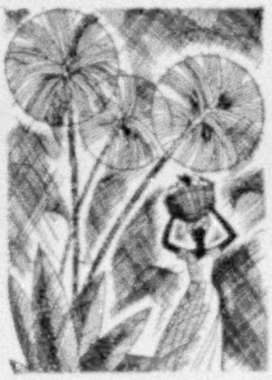

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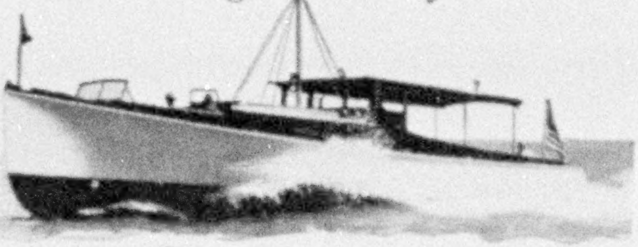

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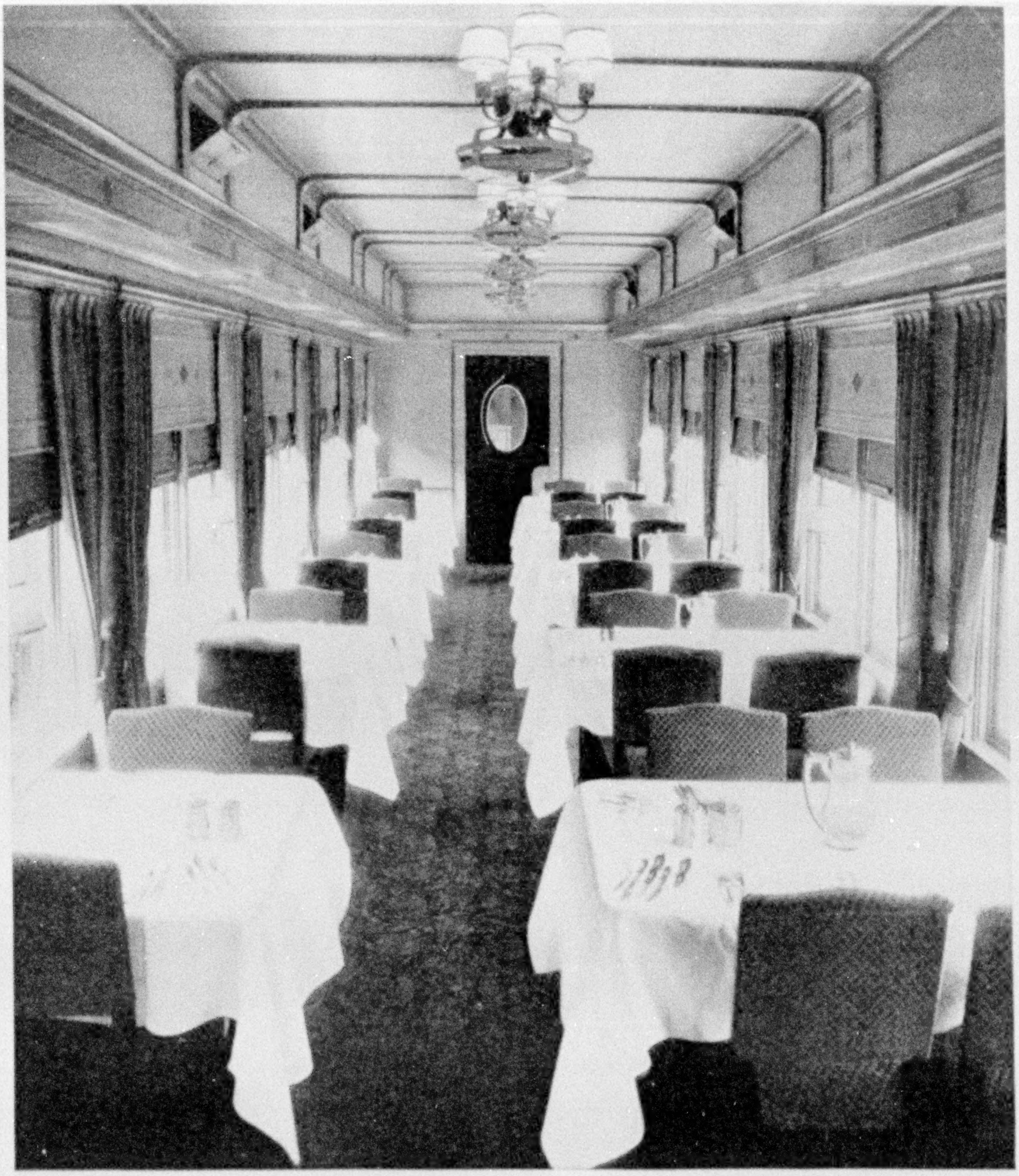

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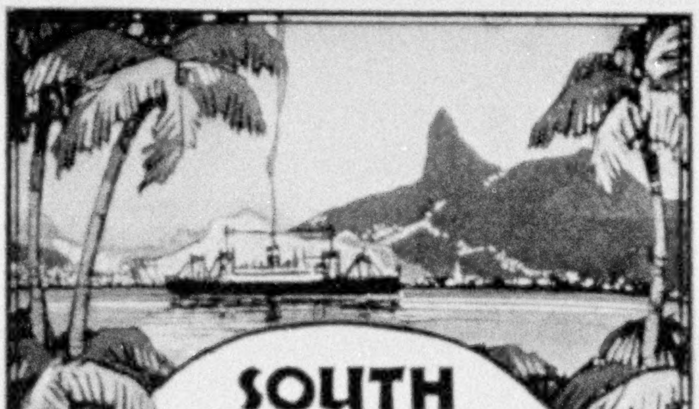

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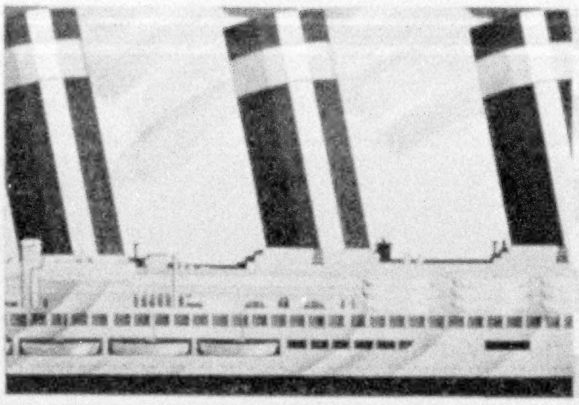

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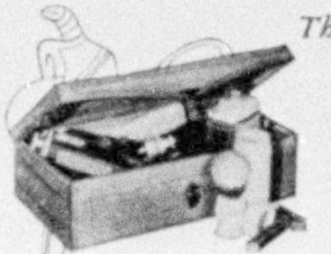

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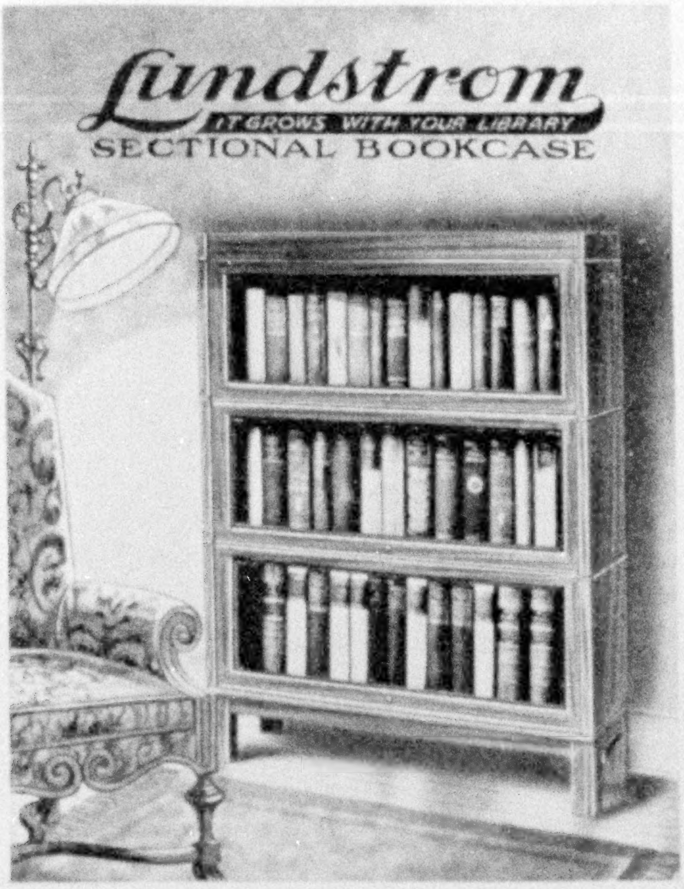

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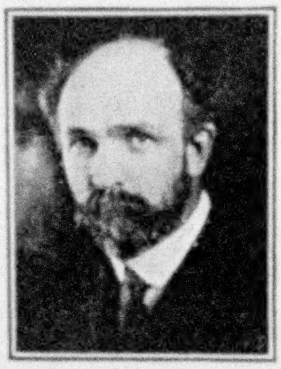

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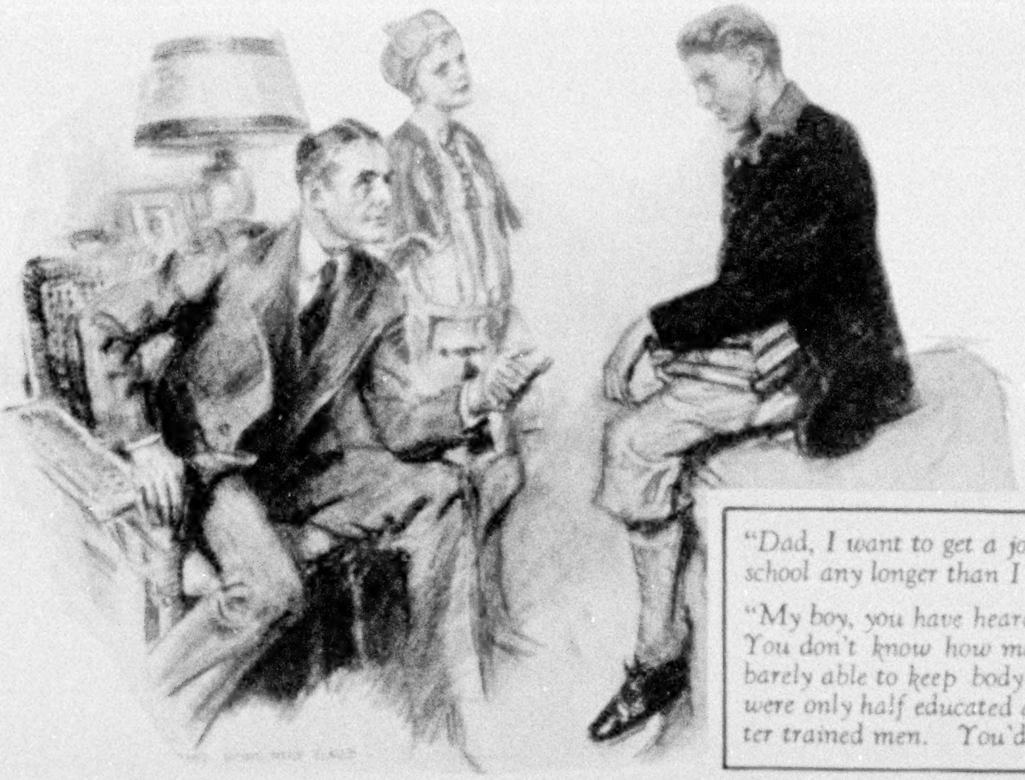

"Dad, I want to get a job. Lots of rich men didn't go to school any longer than I have."

"My boy, you have heard about only the rare exceptions. You don't know how many millions of men have been barely able to keep body and soul together because they were only half educated and unable to compete with better trained men. You'd better go back to school."

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MAYBE it is the boy next door—perhaps it is your own boy—who is eager, restless and ambitious, who would like to quit school and go to work. He is looking forward to the day when he will have more spending money and more independence.

He has read of self-made men who had but little schooling. He sees no reason why he could not do equally well.

Tell him that if he had a chance to talk to one of the big, self-made men of whom he has heard, he would probably be told, "While I was earning a place for myself in the business world I studied at night trying to keep up mentally with my old school friends—even those who went through college."

THE LIGHT THAT NEVER FAILS

Before he is permitted to leave school it would be a great thing if he could talk to some man or woman in charge of employment for a big company. He would learn that the better educated boys and girls are given preference, from the outset, over those who quit school too soon.

In almost every kind of work, whether manual, mechanical, business or professional, higher wages and salaries, in the overwhelming majority of cases, are earned by the best educated and best trained.

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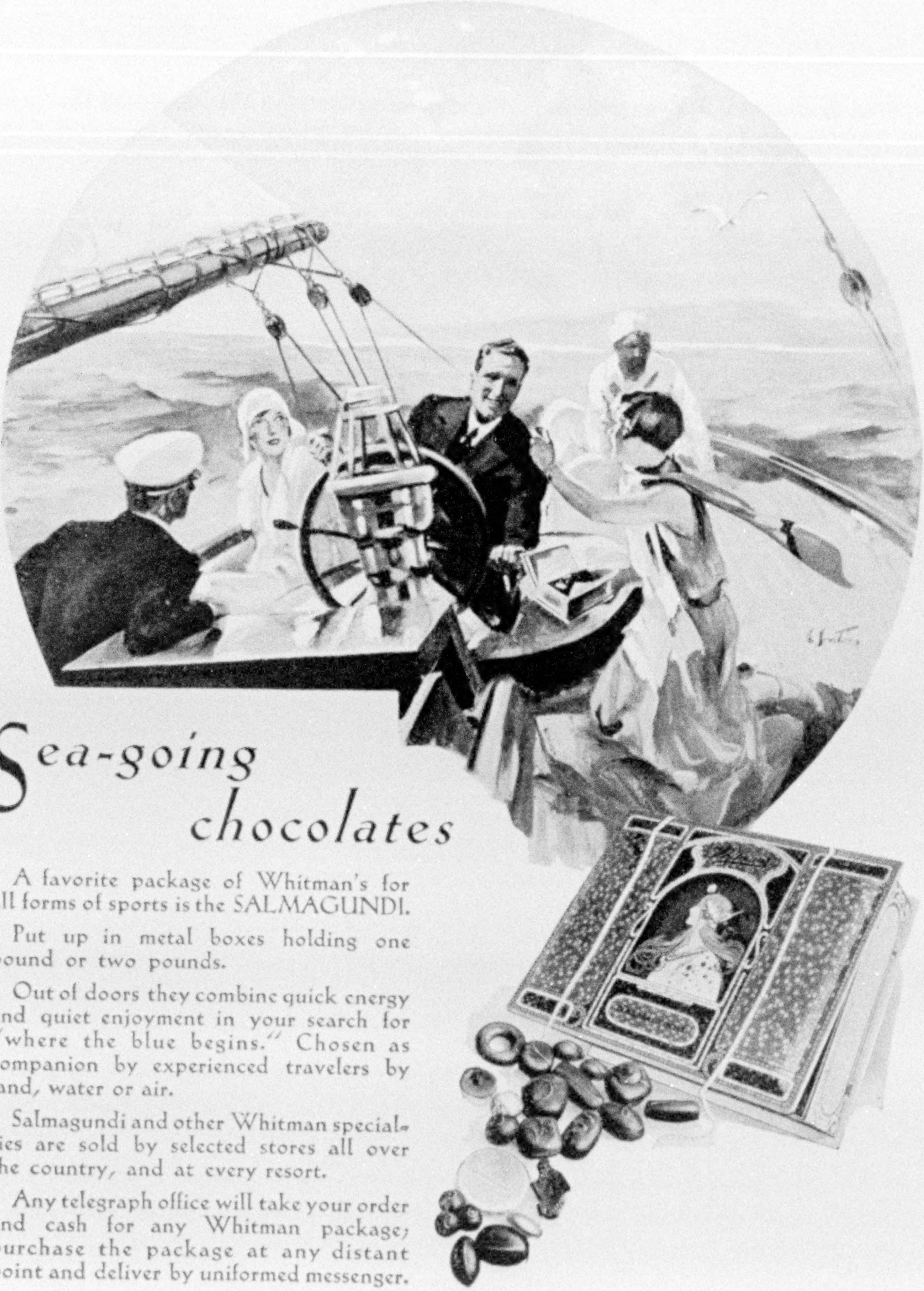

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JUGOSLAVIA—TEN YEARS AFTER

By Melville Chater

Author of "The Shores of Sunrise," "Michigan, Mistress of the Lakes," "The Danube, Highway of Races," etc., etc., in the National Geographic Magazine

A QUARTET of us lingered over our breakfast coffee on an Italianate square at Dubrovnik (Ragusa), regarding the Adriatic's sweep of pastel blue and comparing Armistice memories of ten years before.

We reënvisaged a rush of weeks that were enlivened by hysterical parades, champagne nights, looming revolutions, wholesale kissing, and rumors of old States dissolving, of new States being born. Soon map-makers at the "peace show" were wrestling with the pronunciation of such place names as Przemyśl or stealthily inquiring of their secretaries if Schmöllnitzhütte were mountains or a river.

And so it was small shame that a far-off prospective tourist, upon first hearing of Jugoslavia, had remarked, "Slavia sounds as if it's in Russia, but where is Jugo?" And it was not until the battle dust of the peace conference had subsided and official maps had been published that the uninformed discovered that the Balkan Slavs had constituted themselves as a new State, whose name meant simply "Southern Slavia."

It was a near-by wall placard bearing the official letters "S. H. S." that had served to remind us breakfasters that we were in the Kingdom of Srba, Hrvata, Slovenaca (*i. e.*, Serbs, Croats, and Slovenes) during its decennial year. From Sušak we had coasted along its archipelago-fringed shores—a 680-mile vista of Roman remains, Gothic cathedrals, Italianate campanili seen against the Dinaric Alps' sea-paralleling ridges. And now we were to penetrate their barrier for a glimpse of the less-known interior.

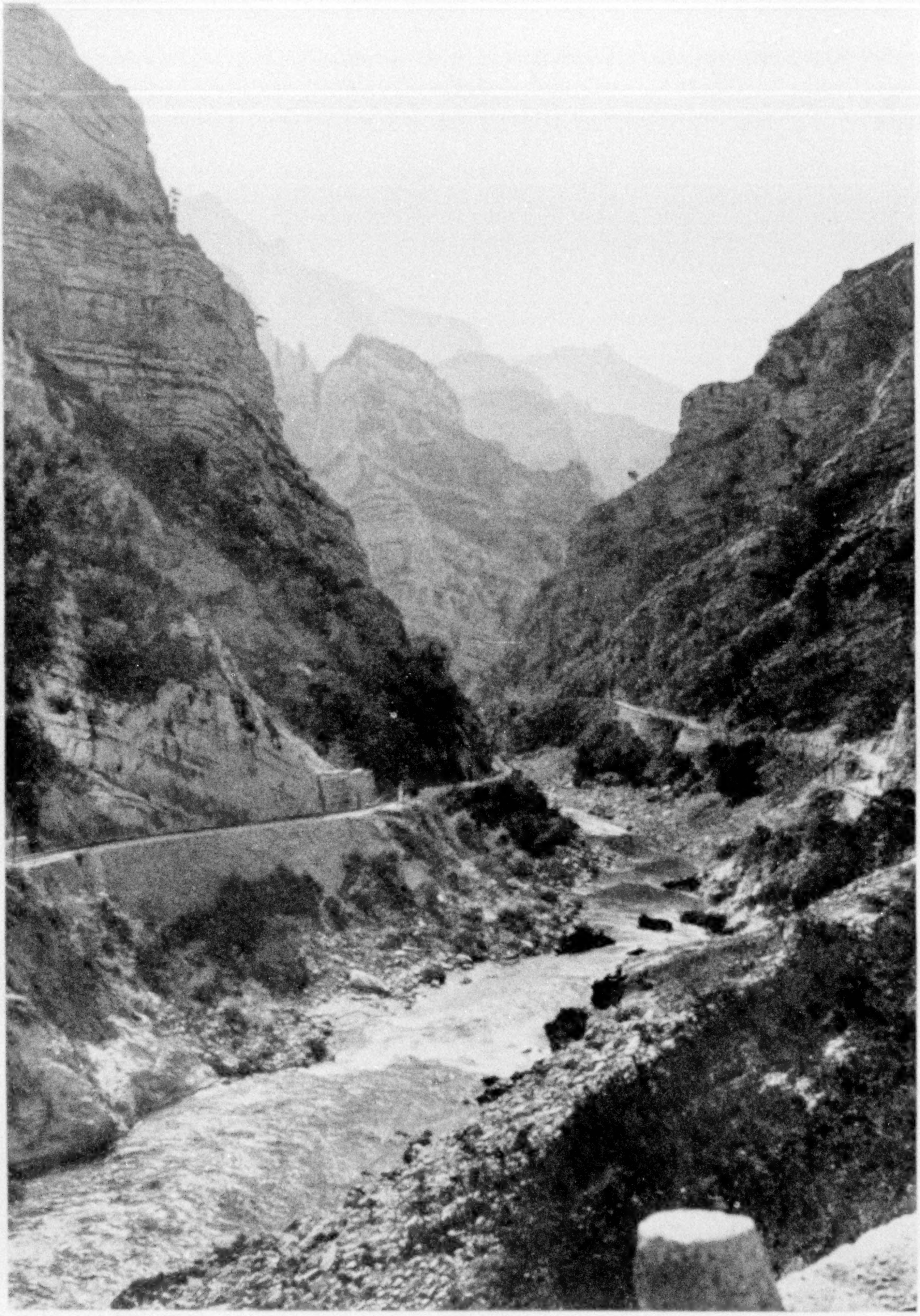
Breakfast over, we sought out Laurence, our chauffeur. Laurence, though untraveled outside of America, was not only a good chauffeur but an excellent cook—something to be considered when motoring through out-of-the-way regions. We found him deep in a language jam with the hotel porter.

Laurence was gesticulating his need of gasoline, the porter was telling him where he could buy "*essence, première qualité,*" and Laurence kept repeating scornfully, "Essence? Man, I don't want no perfumery. What I want is just plain old gas."

And I don't think he believed "essence" could possibly be anything but a drugstore product until he saw the American trademark on the gasoline container.

Dubrovnik sank below us as we zigzagged up the mountains. Seen from their crests, the old walled town appeared like a toy fortress, while the archipelago resembled a blue cloth overscattered with mauve pincushions. Abrupt transition! For ahead of us stretched Hercegovina's Karst region, an unimaginably wild and desolate scene. The seaward flanks of the ridge were clothed in semitropical luxuriance, while on their landward side lay a nude, sterile expanse of rock-heaped, mountain-ringed table-land.

For six hours we traversed that region of the damned. There was scarcely a



Photograph by Melville Chater

THROUGH HILLS OF KARST THE NERETVA HAS CUT A DEEP GORGE

Rivers honeycomb the spongy stone formation in this poorest part of Hercegovina. The barren country offers little for human comfort, and natives of these hills are among the hardiest in Jugoslavia. With a passion for learning, many of them have made brilliant records in the universities.

hut, save for some battered, half-roofless conglomeration of stones. There was scarcely a human face, save for that of some cloaked, sandal-shod goatherd with his skinny flock.

A "POLJE" GLADDENS THE EYE

Now some blanched mountain side revealed an artificially rock-ringed bit of scrub, a pitiable grazing ground, salvaged among the limestone. Occasionally, in a pit among the rocks, appeared an earthy patch about the size of a golf green, plowed for cultivation. It was a "Karst hole," situated over one of the many subterranean streams that pierce this sponge-like, yet stony, region on their way to the sea.

We hadn't spoken for hours, for the Karst had a curiously numbing effect on our spirits, when one of us, like some castaway sighting a sail, pointed to a distant plateau, exclaiming, "Am I dreaming, or is that grass?"

It was. The spot proved to be a *polje,* which means simply "field," although we regarded it more in the light of a heaven-provided oasis. It was a mere ribbon of land, some 16 miles long, dotted with groups of gaily clad peasants who were scything grain. With winter, due to rains and swollen springs, this polje would become a lake sixty feet deep. During the rest of the year it represented the granary of I know not how many villages throughout that sterile region.

For two more hours we wound through the interminable Karst, where bald rocks seemed to grin skull-like over the gloomy scene. At last we skirted a hamlet, then the mountains receded, and we actually beheld trees and heard the trickling waters of a cultivated plain.

GRAVESTONES INTERFERE WITH A SEARCH FOR WATER

Conversation sprang up. Laurence, who had been the gloomiest of the party, produced a tin container and announced that he would get some water for his engine. Five minutes after he had vanished around a bend in the road we beheld him scurrying across lots at a speed quite unusual to him, carrying the empty container.

"It's a buryin' groun'!" he announced in hollow tones.

"Oh, get the water, anyway!" we chorused. But Laurence would not stir. "*Wild* man's buryin' groun'!" he protested sulkily.

Expecting to see the turban-topped headstones of some Moslem cemetery, we cut across the fields. Straddling the road's course across the moor, there appeared a curious community of mortuary monuments. Christian? Moslem? All one could say was that they were certainly ancient. There were square tombs of solid rock shaped like gabled houses. There were lofty stone slabs carved with strange figures—kilted warriors with spear and shield and long-haired patriarchs lifting their arms to heaven—as archaic in appearance as Egyptian tomb carvings.

In puzzled silence we returned to our car.

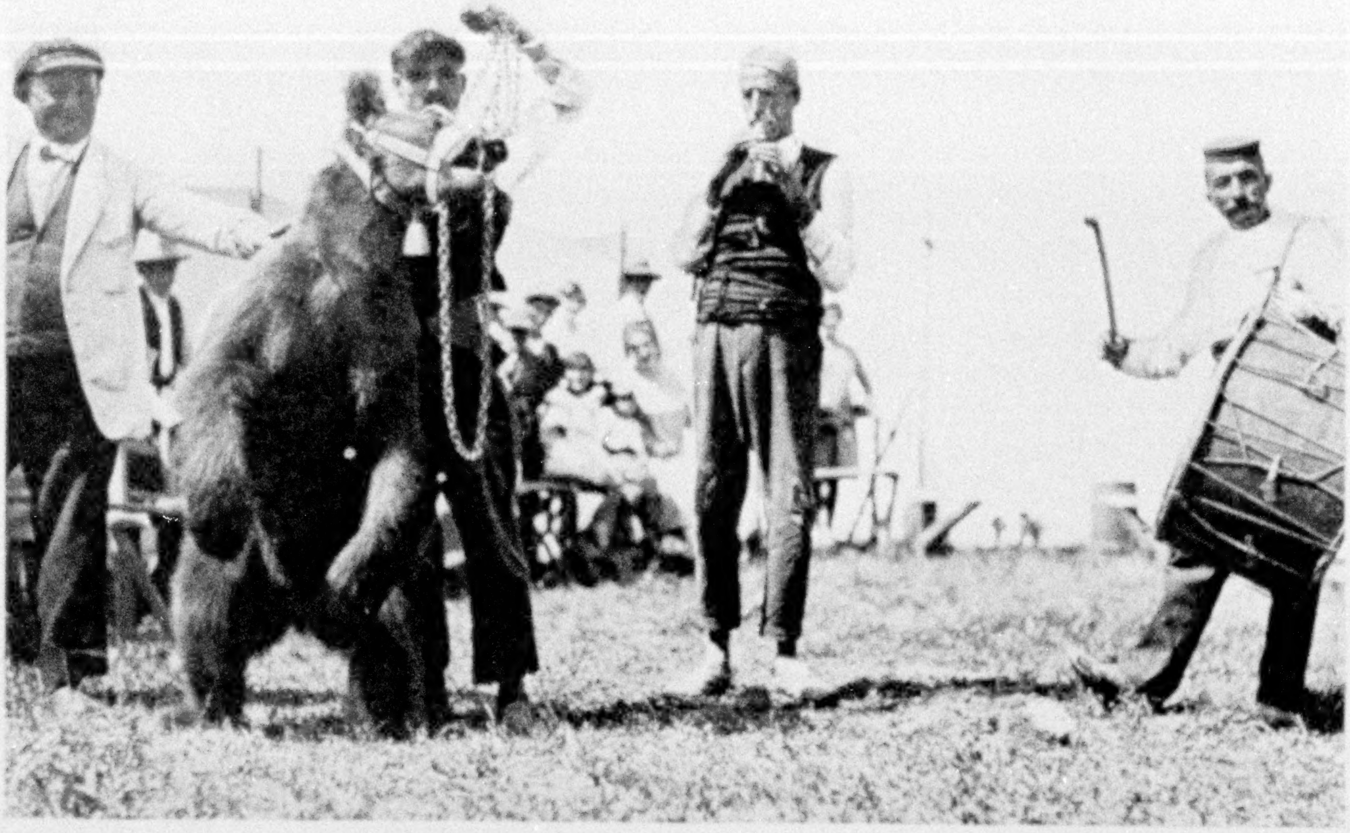
"Huh!" muttered Laurence, as we drove off. "Don't ketch me fillin' ma radiator from no wild man's buryin' groun'!"

A ROD FISHER'S PARADISE

Two hours later, issuing from the Neretva Valley and crossing another polje, we found ourselves in Mostar. All the charm of surprise lay in its spectacle of many minarets agleam over red roofs fringing the swift stream. The Neretva—that strange, Karst-region river, now suddenly in spate, now as suddenly at ebb—has cut the tale of centuries on its steep rock banks. Grotesquely gnarled, they suggest the mad handiwork of some Titan turned carver. Still, as of old, its stone bridge smiles, sunlit, over the angry stream as if secure of faith in its early builders. Still black-hooded, nunlike figures cross and recross it, as Moslem womanhood has done for four centuries, to bazaar booths that display heaped pumpkins, mammoth cabbages, and pink-fleshed fish.

Those fine fish were no less than Neretva salmon trout, as we learned at dinnertime when a splendid specimen, accompanied by a bottle of Mostar's raisin-flavored wine, appeared on our table.

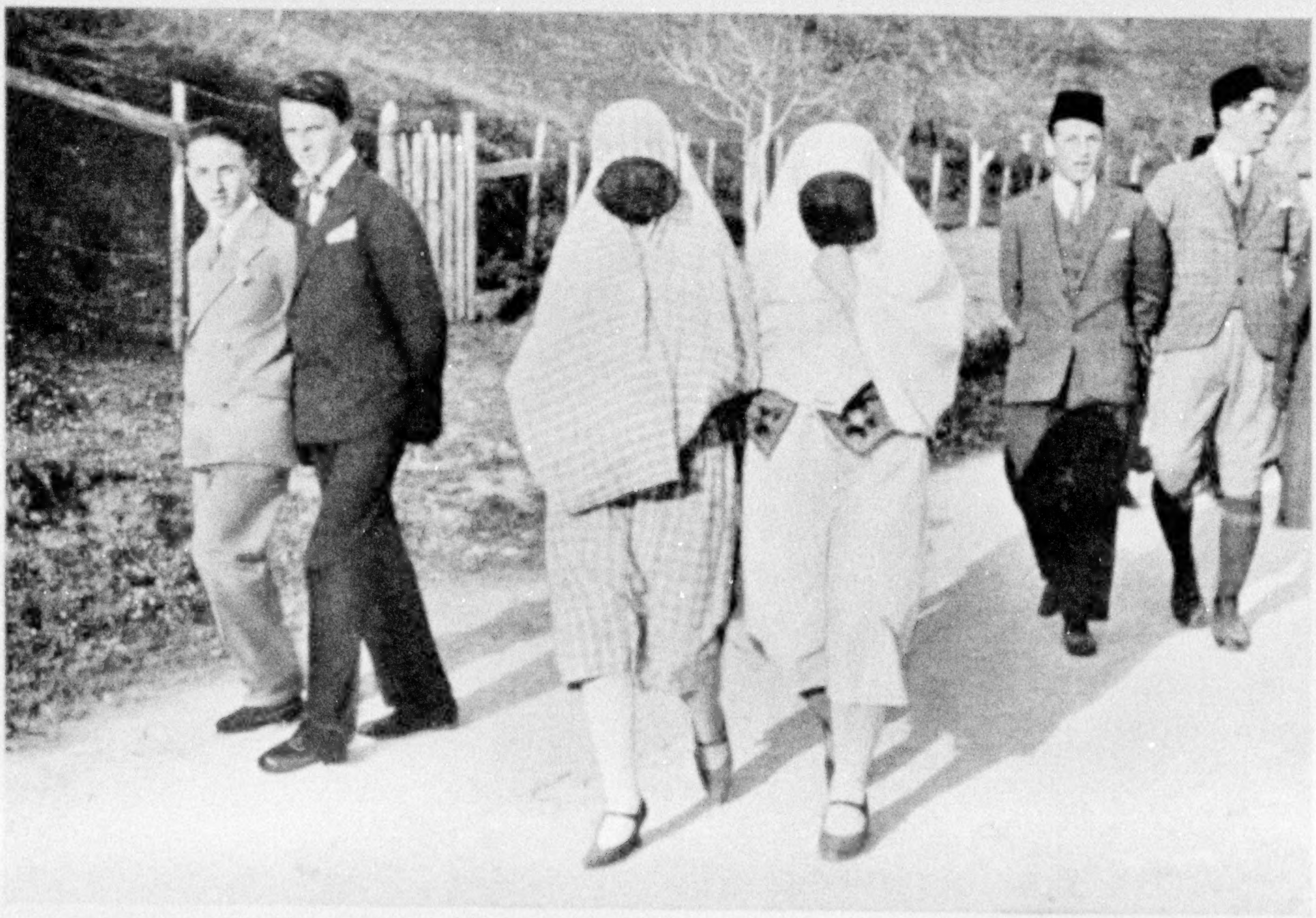
The limestone rivers of Bosnia-Hercegovina constitute a rod fisher's paradise. From the deeper rivers of northern Jugoslavia come gigantic variations of catfish and sturgeon, the latter tipping the scales at 600 pounds and more. As for Jugoslavian trout, the magnificent speckled fellows inhabiting the Government fish



Photograph by Atelje Vlada Benčić

DRUM AND FLAGEOLET SET THE GREAT BEAR DANCING

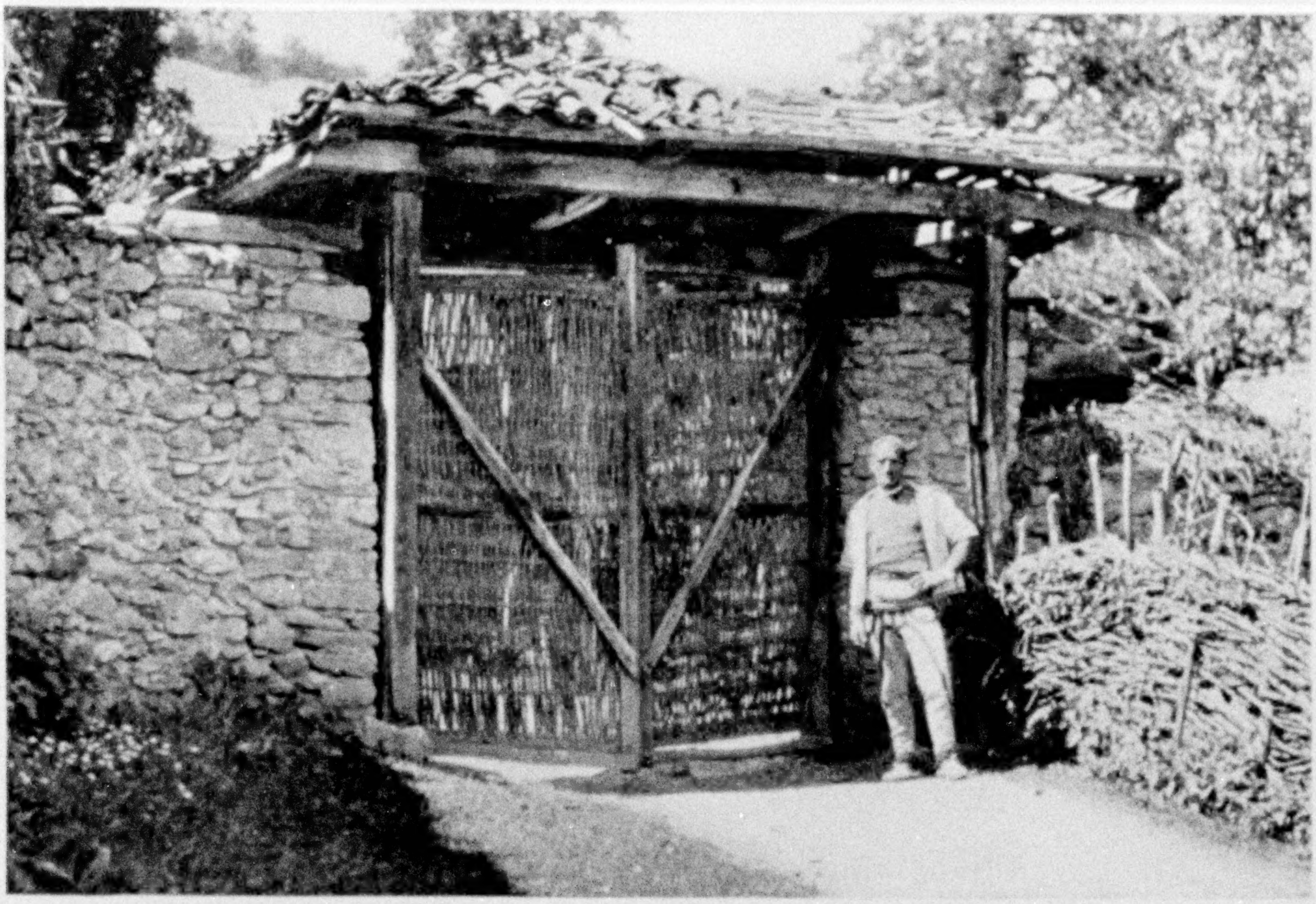
It is always carnival time where southern Serbian gypsies wander. Natural musicians and showmen, they gain a livelihood by entertaining holiday crowds.



Photograph by Alice Schalek

MOSLEM WOMEN ENJOY A SUNDAY PROMENADE

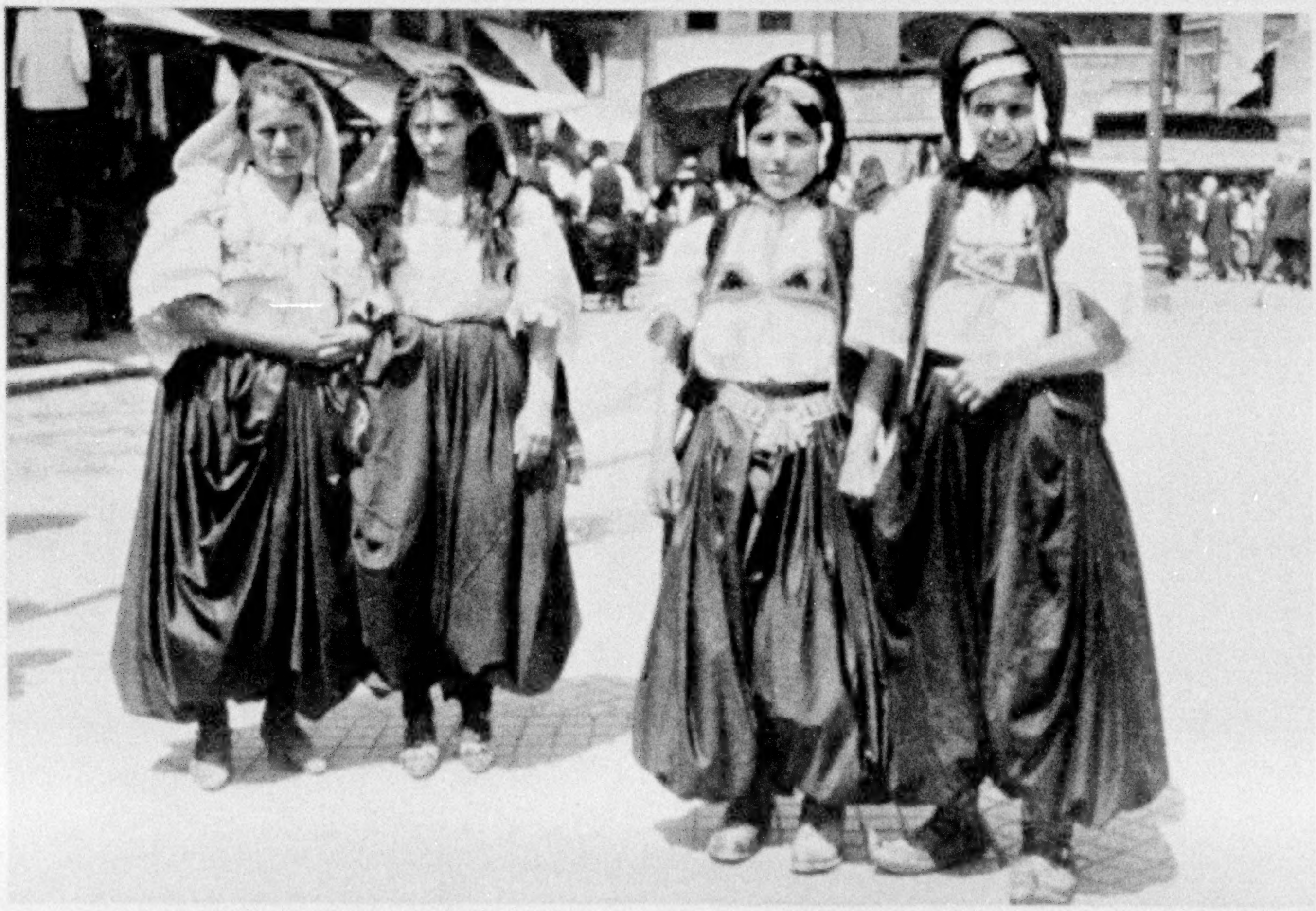
Serbian Mohammedans are descendants of people converted to Islamism by necessity centuries ago (see illustration, page 282), but they adhere more strictly to the forms of their faith than the Turks of Constantinople. Modern custom permits short skirts, but veils are not yet laid aside in public.



Photograph by Mabel Brown Ellis

WOVEN TWIGS MAKE A STRONG GATE FOR A SERBIAN VILLAGE

Doors of the same sort are used in the peasant houses. They serve admirably in summer, but afford scanty protection from winter drafts.



Photograph by Alice Schalek

SARAJEVO GIRLS DISPLAY THEIR DOWRIES AS JEWELRY

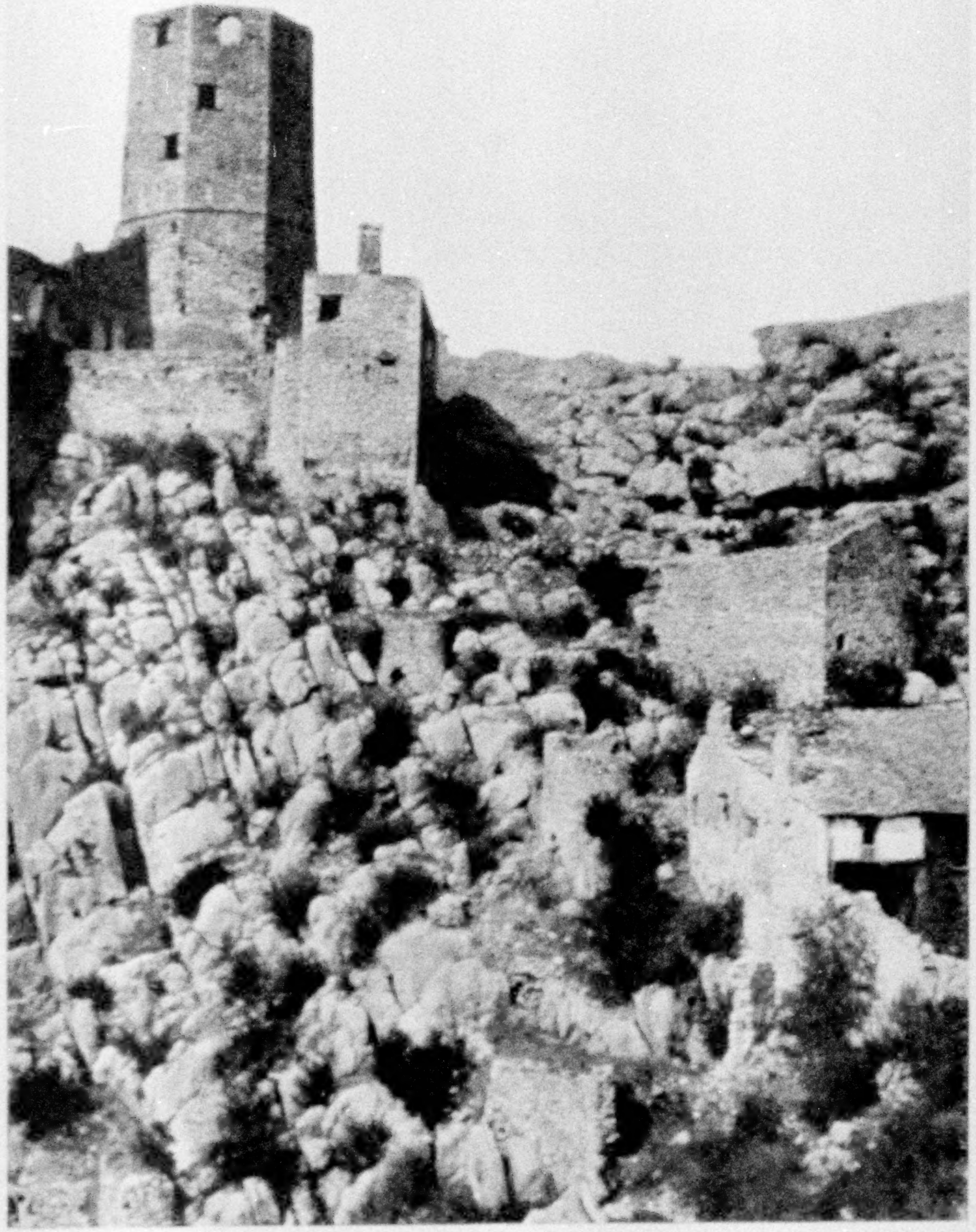
It is easy for the Bosnian youth to learn how much to expect as a wedding settlement when he sets out to select a wife. Each of these young women wears her wealth of gold coins, the two on the left attaching them to their waists, the third fashioning a hair band and a belt of them, and the fourth using them for decoration of her blouse.

Photograph by Melville Chater

THE ARCHWAY OF THE OLD BRIDGE TO MOSTAR

Photograph by Alice Schalek

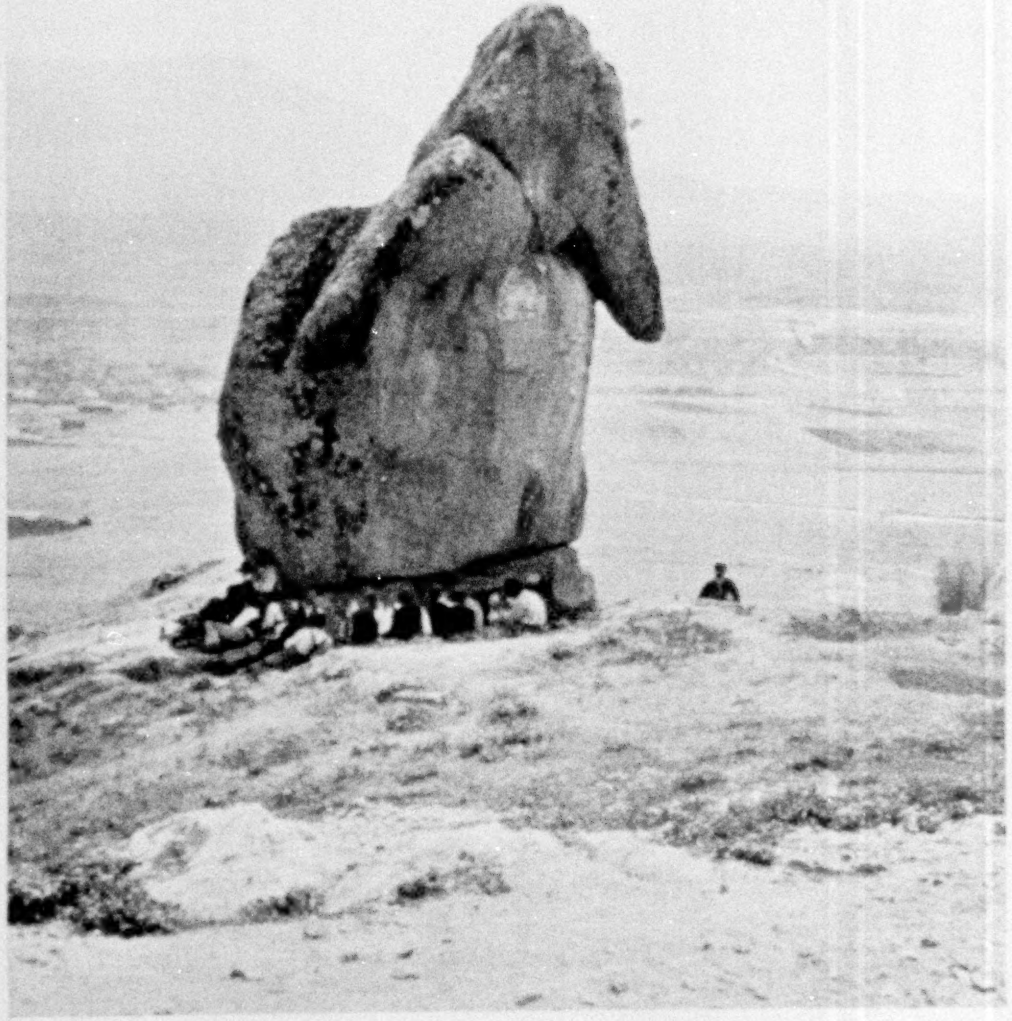
MANY FOLK OF TREBINJE RETAIN THE NATIONAL COSTUME



Photograph by Emil Mezer

POČITELJ'S FORTRESS IS FIVE CENTURIES OLD

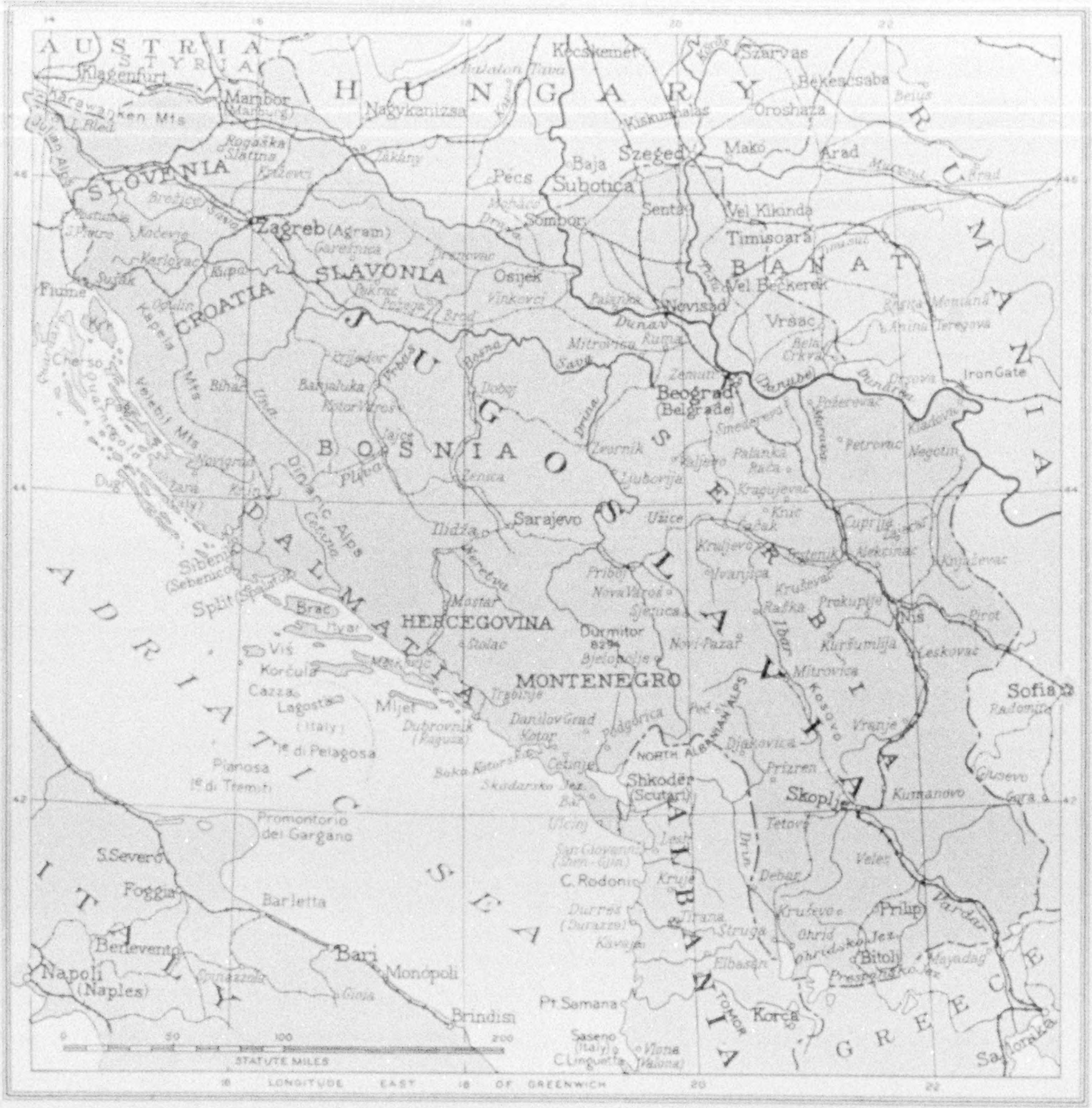
Many such relics of the Moslem conquest crown craggy heights in Hercegovina. This one overlooks the Neretva River near Mostar.



Photograph by Mabel Brown Ellis

A PELICAN IN STONE NEAR PRILIP

Serbian Christians fleeing from the Turks in 1389 worshiped at this rock in southern Jugoslavia.


AUSTRIA
STYRIA
Klagenfurt
Karawanken Mts
HUNGARY
Kecskemet
Szarvas
Bekescsaba
Maribor (Marburg)
Nagykanizsa
Kiskunhalas
Oroshaza
SLOVENIA
Pecs
Baja
Szeged
Mako
Arad
Subotica
RUMANIA
Zagreb (Agram)
Sombor
Senta
Vel Kikinda
Timisoara
Sušak
Fiume
SLAVONIA
Osijek
BANAT
Vel Beckerek
CROATIA
Novisad
Vrsac
Cherso
JUGOSLAVIA
Beograd (Belgrade)
Iron Gate
BOSNIA
SERBIA
Sarajevo
Ilidža
Sibenik (Sebenico)
Split (Spalato)
DALMATIA
Brač
Hvar
Viš
Korčula
HERCEGOVINA
Mostar
Durmitor
MONTENEGRO
Niš
Sofia
Cazza
Lagosta (Italy)
Mljet
Dubrovnik (Ragusa)
Kotor
Cetinje
Pianosa
Iª di Pelagosa
Iª di Tremiti
NORTH ALBANIAN ALPS
Shkoder (Scutari)
Skoplje
Kumanovo
ADRIATIC SEA
Promontorio del Gargano
S. Severo
Foggia
Barletta
C. Rodoni
ALBANIA
Prilip
Bitolj
GREECE
ITALY
Benevento
Napoli (Naples)
Bari
Monopoli
Brindisi
Pt. Samana
Korca
Saseno (Italy)
C. Linguetta
Vlona (Valona)
Salonika
0 50 100 200
STATUTE MILES
LONGITUDE EAST OF GREENWICH

JUGOSLAVIA IS AN AMALGAMATION OF MANY STATES

After the World War, Slovenia, Croatia, Slavonia, Bosnia, Hercegovina, Dalmatia, part of Banat, and the Kingdom of Montenegro were added to Serbia to compose a kingdom of 96,000 square miles, with a population of 13,000,000.

breederies at Ilidža, near Sarajevo, stir the fishing fan's heart with an unholy covetousness. We were later to make the acquaintance of those Ilidža trout under unusual circumstances.

Thanks to a Mostar acquaintance, we learned that the "wild man's burying ground" was a Patarene cemetery. Those heretics, earlier known as Bogomils, anticipated modern skepticism as to Christ's divinity, the sacraments, and the miracles by some ten centuries. Although they were severely persecuted, Bogomil propaganda spread westward over Europe's mountain chains. Many of the sect took refuge in the Bosnian wilds, holding out until the end of the fifteenth century, when they were engulfed by Islam.

SCENIC GRANDEUR REPLACES DESOLATE WASTES

The Karst region was now behind us and scenic rewards lay ahead. Next day we threaded a mighty canyon, some 18 miles long, where the Neretva rushed headlong between skyscraping walls of rock. Here, during seasonal high waters, the river sometimes rises from shallowness to 40 feet in depth during 24 hours.

We were yet to realize how essentially Jugoslavia is a land of waterways and of largely undeveloped water power. The

Danube and its branches alone give her almost 1,000 miles of navigable routes, this in a State slightly smaller than Wyoming. These, together with unnavigable streams, give Jugoslavia a total potential energy in some seasons of almost 9,000,000 horsepower.

An hour or so beyond the canyon we began to skirt magnificent stands of oak, birch, and evergreen. We gained the top of the watershed, then coasted down into well-watered, forest-ringed plains, where lumber mills were interspersed among those busy little grain mills, almost toylike in size, that multitudinously range themselves along every Bosnian stream.

A land of abrupt transitions! Within 24 hours we had successively observed Dalmatia's semitropic luxuriance, Hercegovina's sterile Karst, and a forest region which contains some of the finest stands of timber in Europe. In a kingdom which is one-third forested and reckons one-third of its industrial values in terms of wood or wood products, Bosnia-Hercegovina leads, with 50 per cent of its surface classifiable as "forest area."

Bosnia possesses one of the largest wood-distilling plants on the Continent. "Bosnian oak staves" have contributed a trade phrase ever since the days when the country exported 60,000,000 of them annually. And it may surprise city folk, who are more aware of shoe-trees than tree-shoes, to know that Jugoslavia turns out 600,000 pairs of sabots a year.

PEACE PREVAILS WHERE THE WORLD WAS SENT TO WAR

That night we sat outdoors over our coffee in hill-cupped Sarajevo. A peaceful evening, a strolling crowd, a boulevard paralleling the moon-kissed river. Not a stone's throw away rose the bridge from near which, in June, 1914, was fired the revolver shot whose echoes shook the world (see Color Plate II).

A local acquaintance, young Abdul of the gazelle eyes and tilted fez, was giving us Sarajevo's traditional account of the Archduke's assassination. As is usual in Balkan political exegesis, he started off with causes in the Middle Ages and gradually worked down to effects in modern times. He said that the Southern Slavs' struggle for independence began with the uprisings of 1804-1813. During the next decade there had developed the foundations of a new Serbian State, which thenceforward assumed the rôle of liberator. Three subsequent wars against the Turks, and especially that of 1912, had served to heighten Southern Slavism's hopes, much to the anxiety of their Austro-Hungarian rulers.

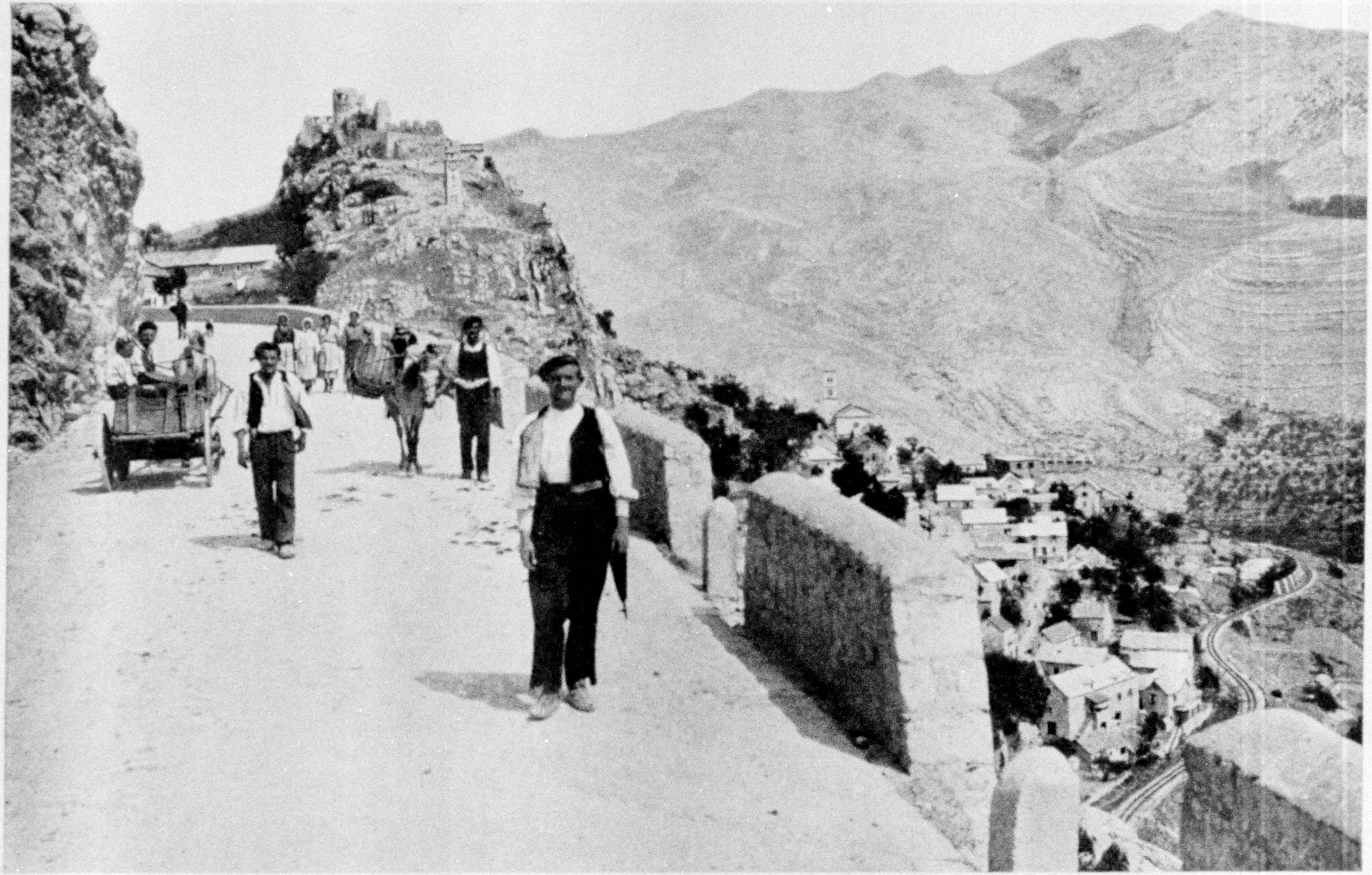
"The Archduke," he went on, "was here to inspect maneuvers. Now, such displays weren't very popular among the young Bosnian nationalists. Several of those in the plot had actually written to friends in Austria, 'Watch for big happenings on June 28.'

"Well, the first thing that happened was an unsuccessful bomb that landed in front of the Archduke's car. He summoned the mayor and said angrily, 'I expect to be greeted with flowers, not with bombs.' But no amount of police protection would have availed, for as many as thirty assassins were stationed along the line of march. The second one, pushing through the cordon, killed the Archduke and his consort with two revolver shots—an affair of five seconds that changed the map of Europe."

VEILS AND FEZZES STILL WORN IN SARAJEVO

Next morning we trickled through the thronged *Čarsija,* Sarajevo's bazaar quarter, with Abdul's red fez ahead of us as a beacon. But a derby "lid," such as Constantinople has imposed upon its Moslems, would have proved, among the Čarsija's sea of fezzes, a far more effective landmark; for Sarajevo's 20,000 Mohammedans, placidly indifferent to Western costume, remain draped, veiled, and fezzed as of old, with the result that Constantinople's streets now appear pale when compared with the glowing pageant of Bosnia's capital.

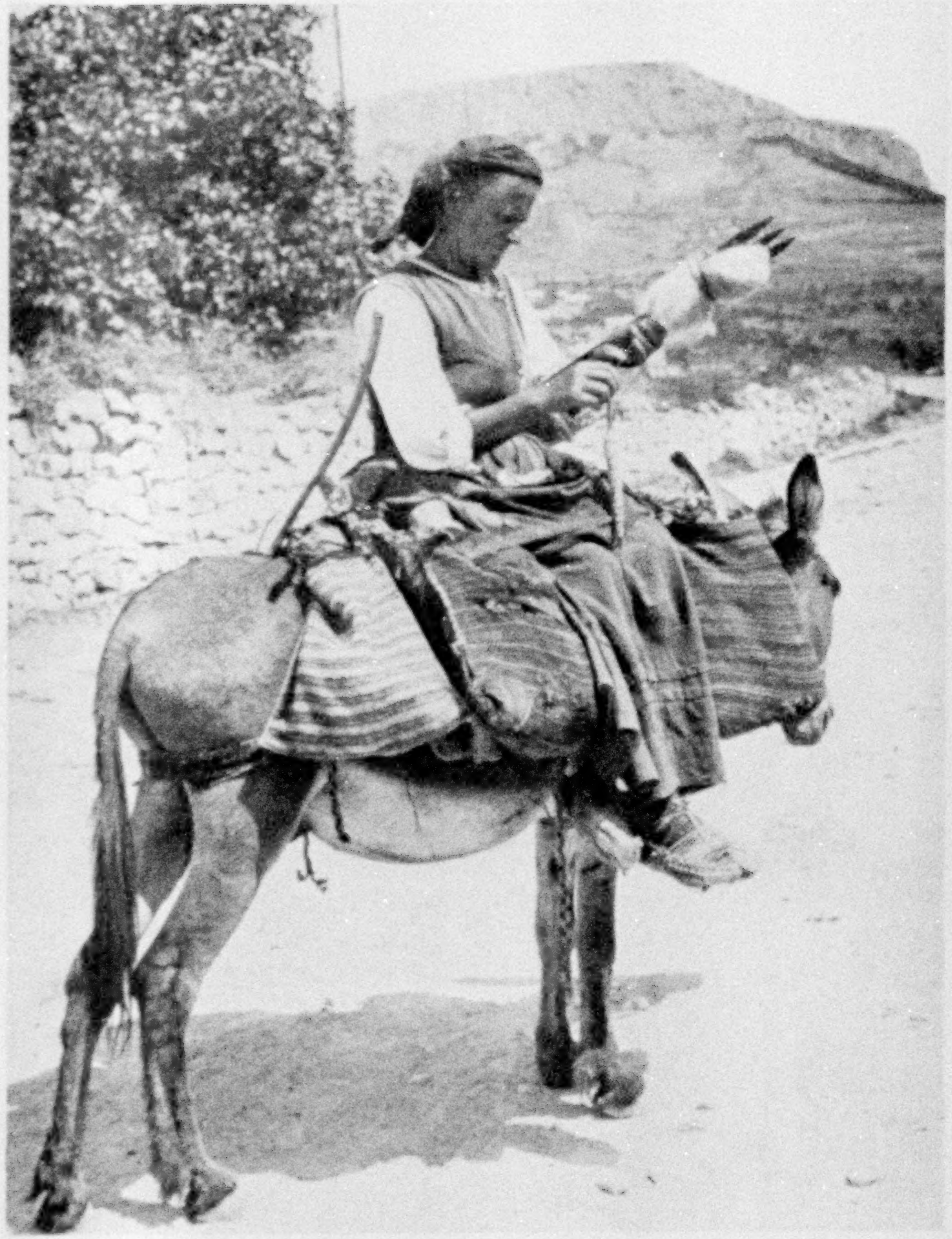
Despite its prevailingly European architecture and its occidental race elements in a population of 80,000, Sarajevo remains for Europe the westernmost of oriental cities. Her bulbous mosques, their spacious fore-courts, their groups of foot-washers or of kneelers, abased, slavelike as under Allah's hand; her hundred minarets, rising heavenward like altar candles; the black-veiled figures gliding phantomlike past; the courtyard caravansaries, the fragrant kebabs sizzling on charcoal; the



Photograph by Ewing Galloway

AMONG ROCKY DALMATIAN HIGHLANDS LIES THE ROMANTIC VILLAGE OF KLIS (CLISSA)

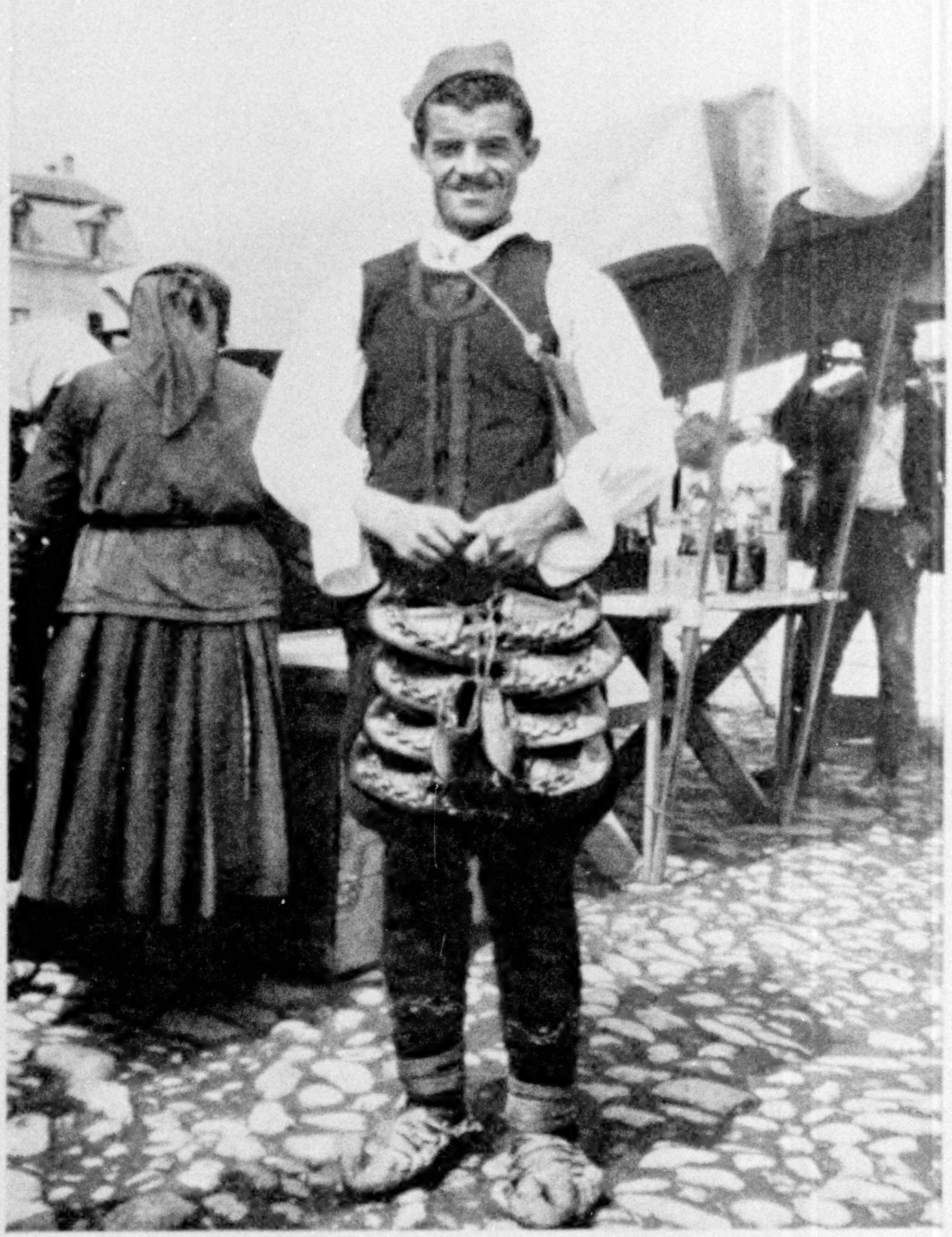
The old castle on the promontory at the upper left was an important stronghold in the Turkish wars. Across the valley Monte Mosor looms. People of this district gain a livelihood by sheep-raising and farming, though there is little tillable soil in the rough hill country. The sinuous railway and the mountain road hewn by generations of peasants link the town to Split (Spalato).



Photograph by Ewing Galloway

SPINNING RELIEVES THE MONOTONY OF DONKEY TRAVEL

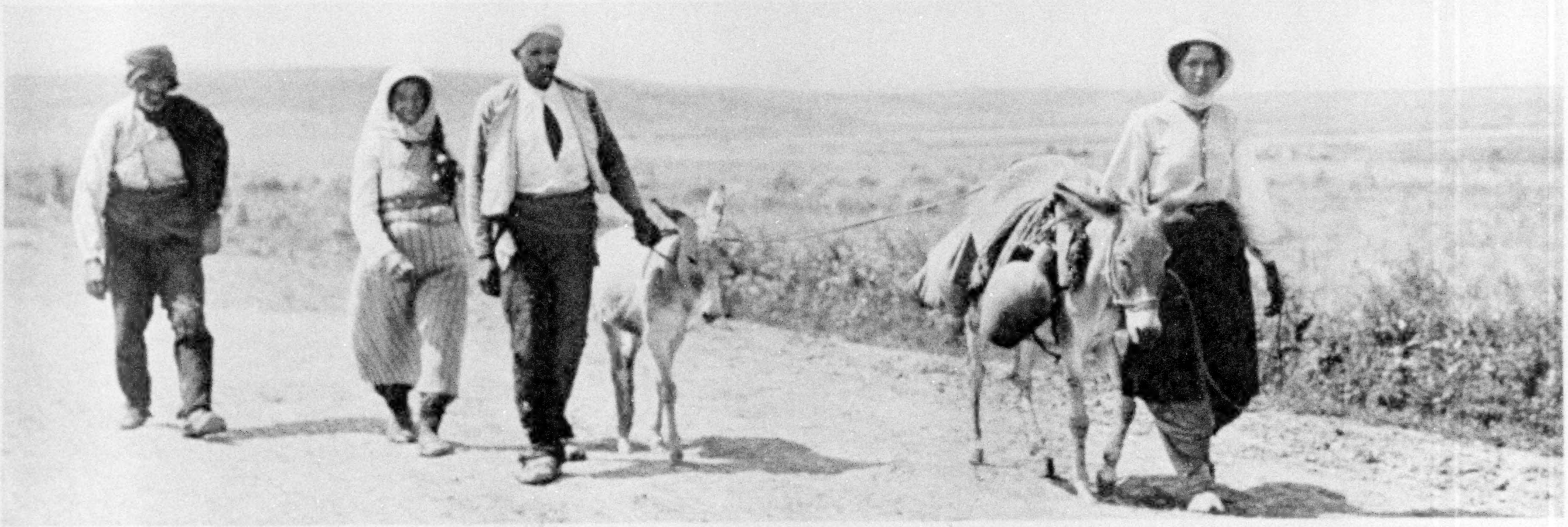
On her way to the village of Klis (see illustration, opposite page) the Dalmatian woman loses no time from her housewifely duties.



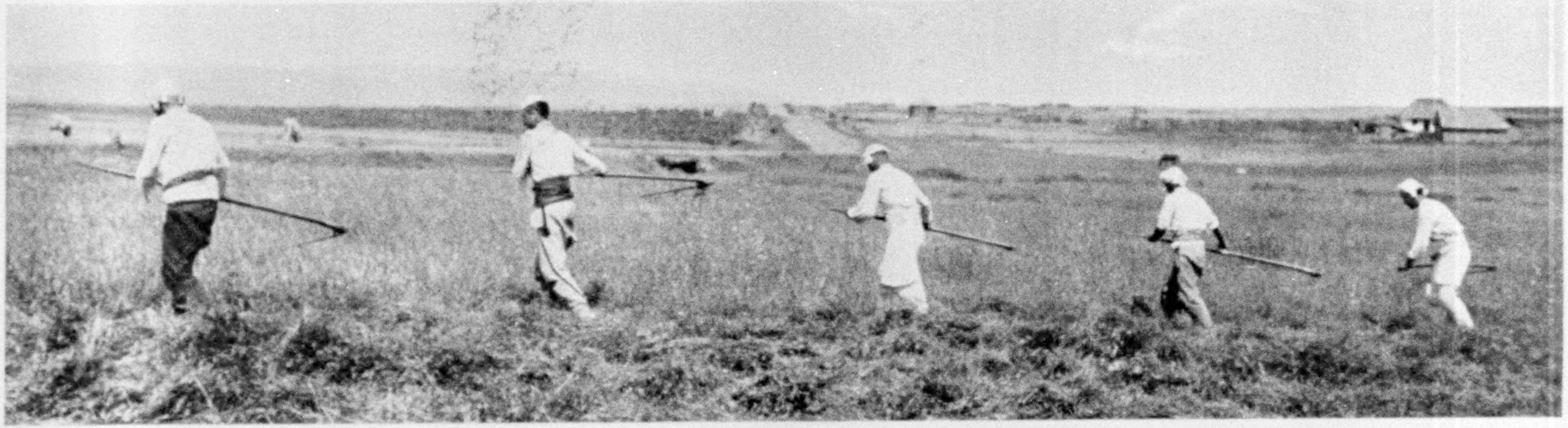
Photograph by Bertram Brotherton

A UŽICE SHOE MERCHANT

Many Serbian peasants make their own footwear, a sort of leather moccasin. The merchant has on a pair similar to those he carries.



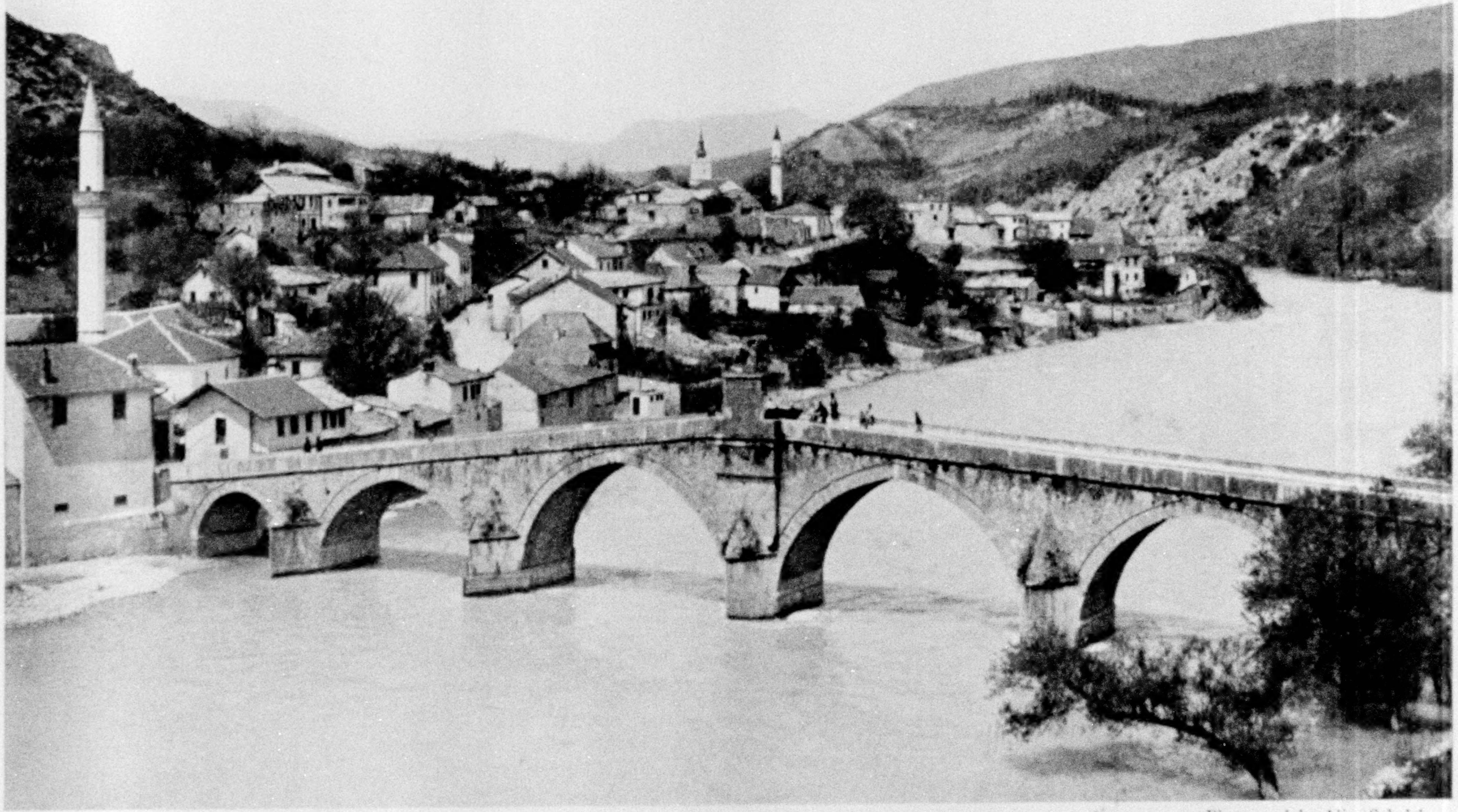
WHERE THE EAST BEGINS, DONKEYS COME INTO USE AS PACK ANIMALS: PEASANTS ON THEIR WAY TO MARKET ACROSS THE PLAIN OF KOSOVO



Photographs by Hans Hildenbrand

AGRICULTURAL MACHINERY IS ALMOST UNKNOWN IN SOUTHERN JUGOSLAVIA

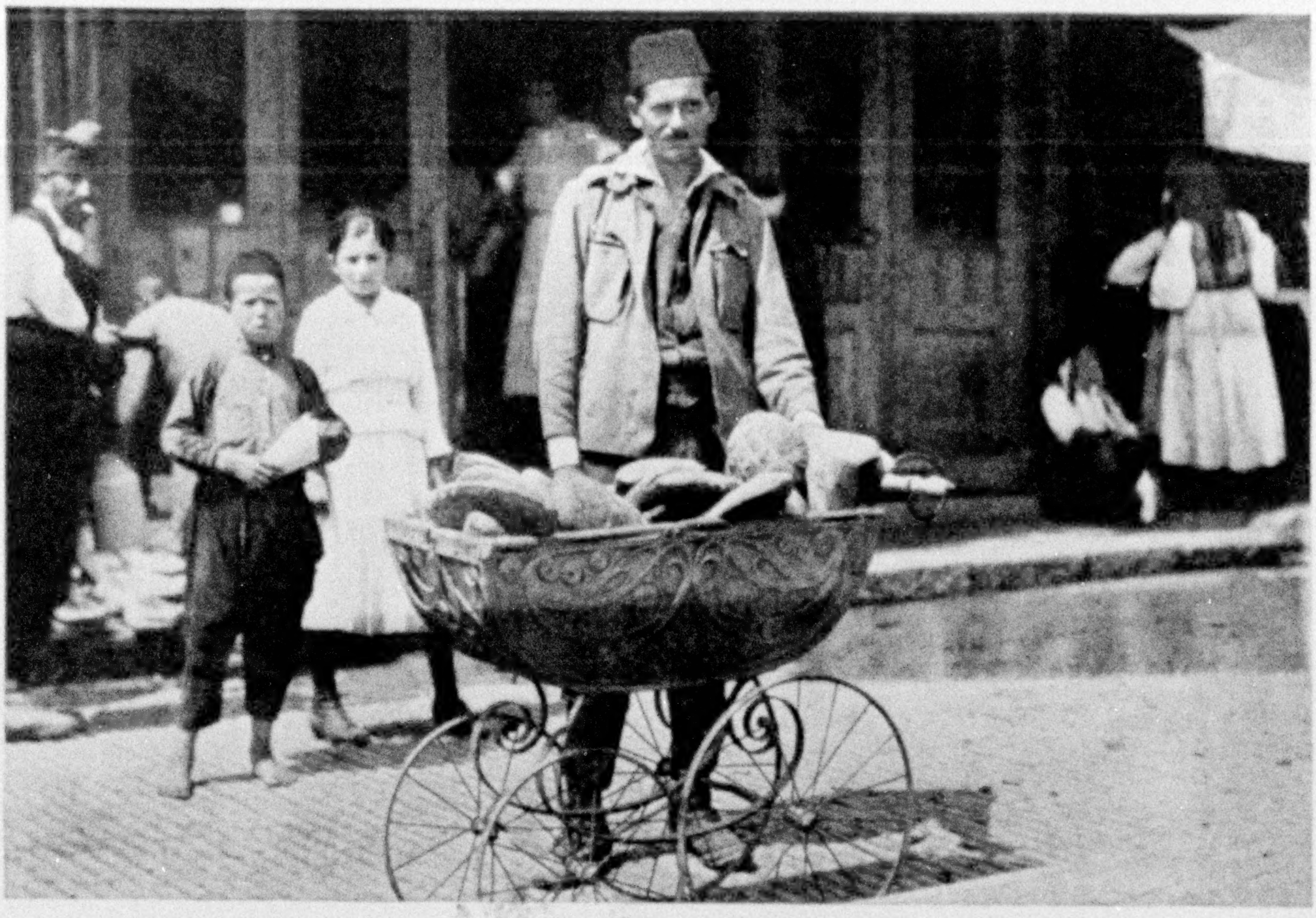
Peasants are cutting grain from Kosovo Polje (the Plain of the Blackbirds), scene of the battle between the South Slavs and the Turks, in which the former lost their independence (see, also, Color Plate XIV).



Photograph by Alice Schalek

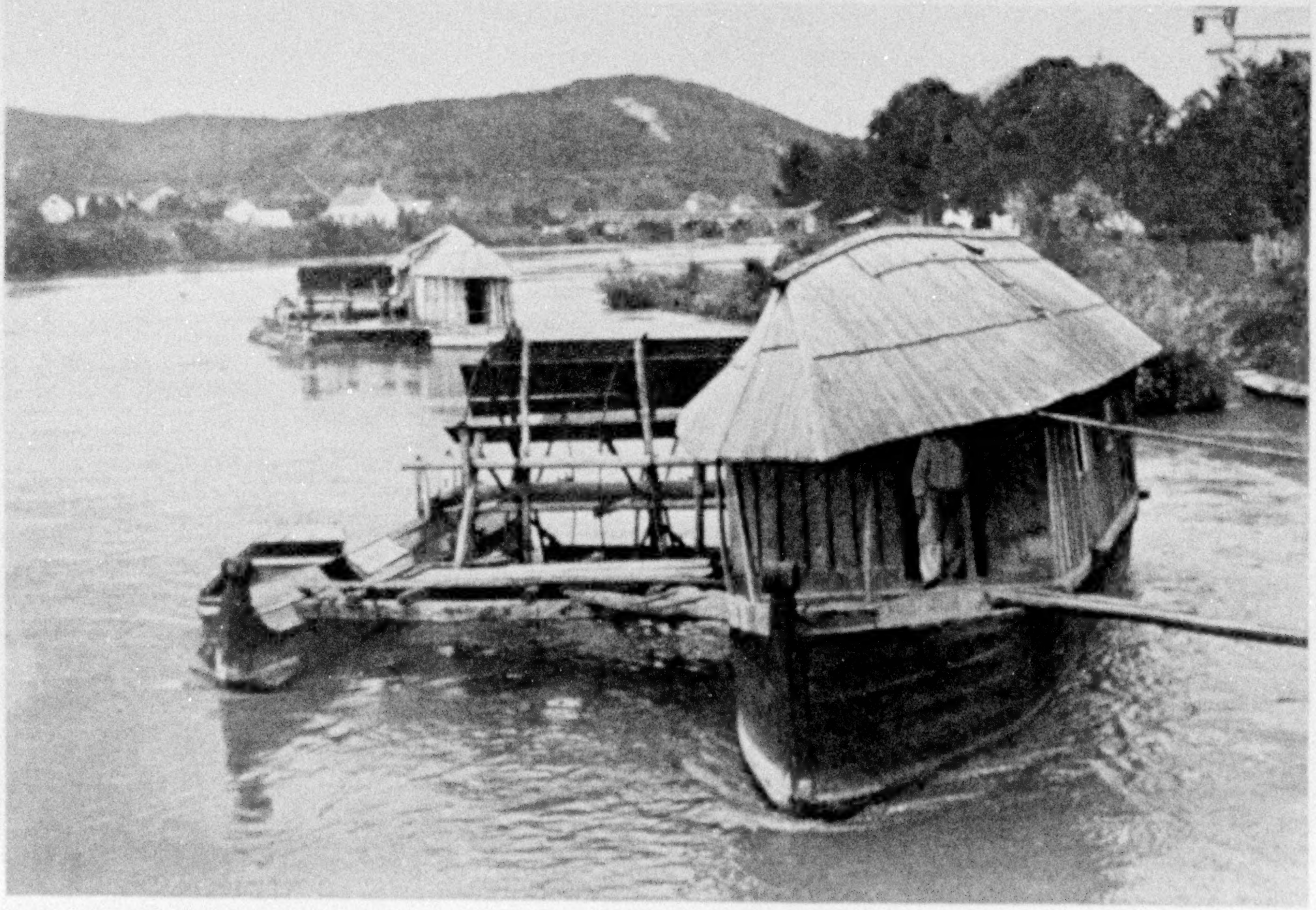
THE BRIDGE ACROSS THE NERETVA AT JABLANICA ONCE RANG TO THE TRAMP OF ROMAN LEGIONS

With its Moslem mosques, ancient structures, and impressive mountain scenery in the vicinity, this village between Sarajevo and Mostar attracts many travelers.



Photograph by Merl La Voy

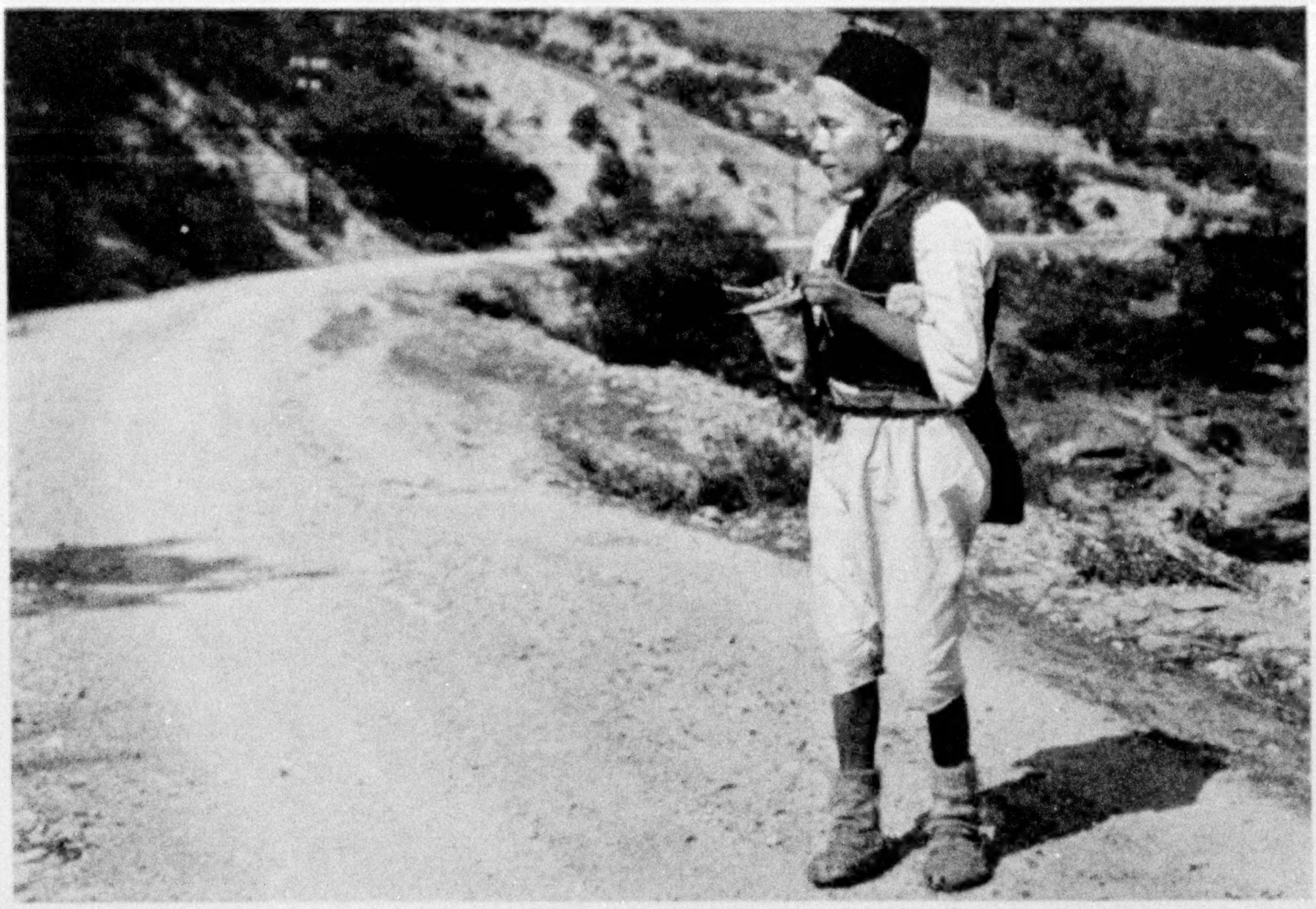
HIS SARAJEVO BREAD WAGON BEGAN SERVICE AS A BABY CARRIAGE



Photograph by Rudo Bruner-Dvořák

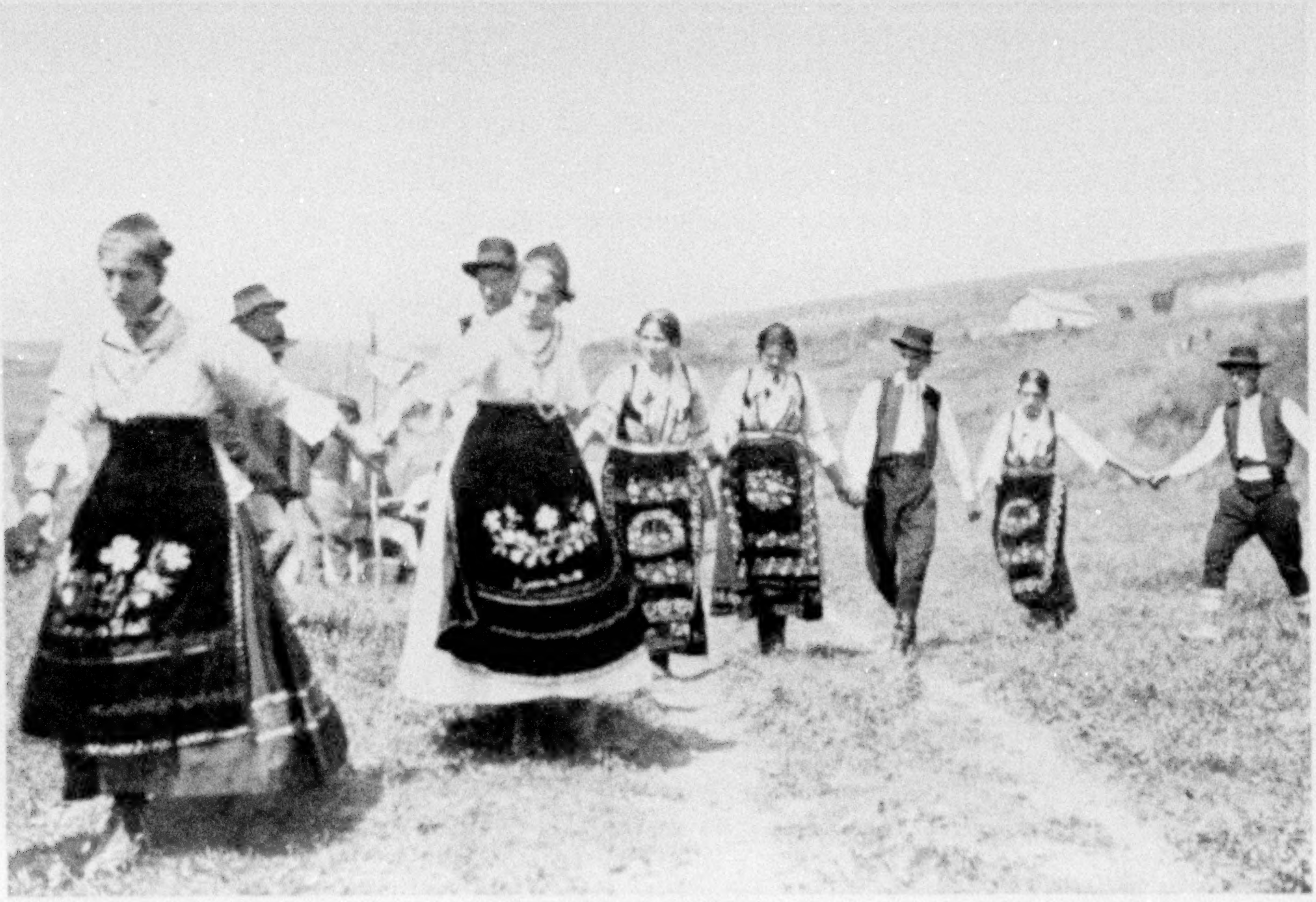
FLOATING MILLS GRIND THE GRAIN FROM BOSNIAN RIVER FARMS

In the World War these devices were pressed into service for the construction of pontoon bridges for the passage of troops.



Photograph by Melville Chater

KNITTING KEEPS HERCEGOVINA OUT OF MISCHIEF BETWEEN HOME AND SCHOOL



Photograph by Atelje Vlada Benčić

WHEREVER SERBS MAKE MERRY, THE KOLO IS DANCED

Even in World War trenches, soldiers of this hardy people kept up their spirits by joining hands and circling about in the steps of their national dance.

amazing craftwork in leather and in metal, wrought along dark alleyways of floorless, impermanent booths—of such scenes Sarajevo creates the timeless mosaic of oriental life. Yes, here is the very essence of the hodgepodge, lovable East, lying so strangely juxtaposed to Adriatic coasts of campanile and cathedral.

TREASURES OF FOUR CENTURIES UNFOLD

"And now," said Abdul, "I will show you our family storeroom, which we have owned ever since coming from Trebizond, centuries ago."

Leading the way, he presently applied a gigantic key to a ponderous door. We found ourselves in a dim storage vault of the seventeenth century; or, rather, it was a kind of Ali Baba's cave, odorous of attar and aflash with gold. Then Abdul switched on the lights, and we saw that the "gold" was appliquéd as exquisite tracery over a series of the most magnificent gowns, flowing-sleeved dalmatics stiff with brocade, that ever adorned the wife or daughter of some Bosnian merchant prince.

"Mohammedan work, but only two centuries old," said Abdul patronizingly. "And there are rugs——"

He tossed them out of deep chests—subtle Persians, glamorously barbaric Afghanistans, and a Damascene of which only four originals are known to exist. We gloated, we burbled inadequately.

"I know," sighed Abdul, eyeing us with hypnotic sympathy, "you look at the Damascene; you want to keess it. Now you begin to feel a little seeck, yes?" (He meant "faint.") "Effendim, hadn't I better put this too lovely mistress of a rug out of sight?"

Yes, for supersalesmanship I will back Abdul, of the gazelle eyes and flutelike voice, against any rug department spellbinder that ever lived.

Abdul's ancestral storeroom remains a relic of the old days, when Sarajevo flourished exceedingly as a caravan stop on the Venice-to-Constantinople route. Trans-Adriatic merchandise arriving by galley at Dubrovnik was reloaded on mules; then the caravan wound its way eastward across the wild Karst. Half a mile ahead marched the expedition's least-envied man, beating a drum. So long as the sound continued, one knew that all was well. If the sound ceased, one fled, realizing that the scout had been killed by brigands.

Some work on our car having become necessary, we occupied the interim with a rail trip into South Serbia. Over a narrow-gauge line we climbed eastward through a succession of remote mountain defiles and Alpine lowlands. Beyond Užice we descended through the Morava Valley into wide plains; then headed southward for Skoplje (Uskub).

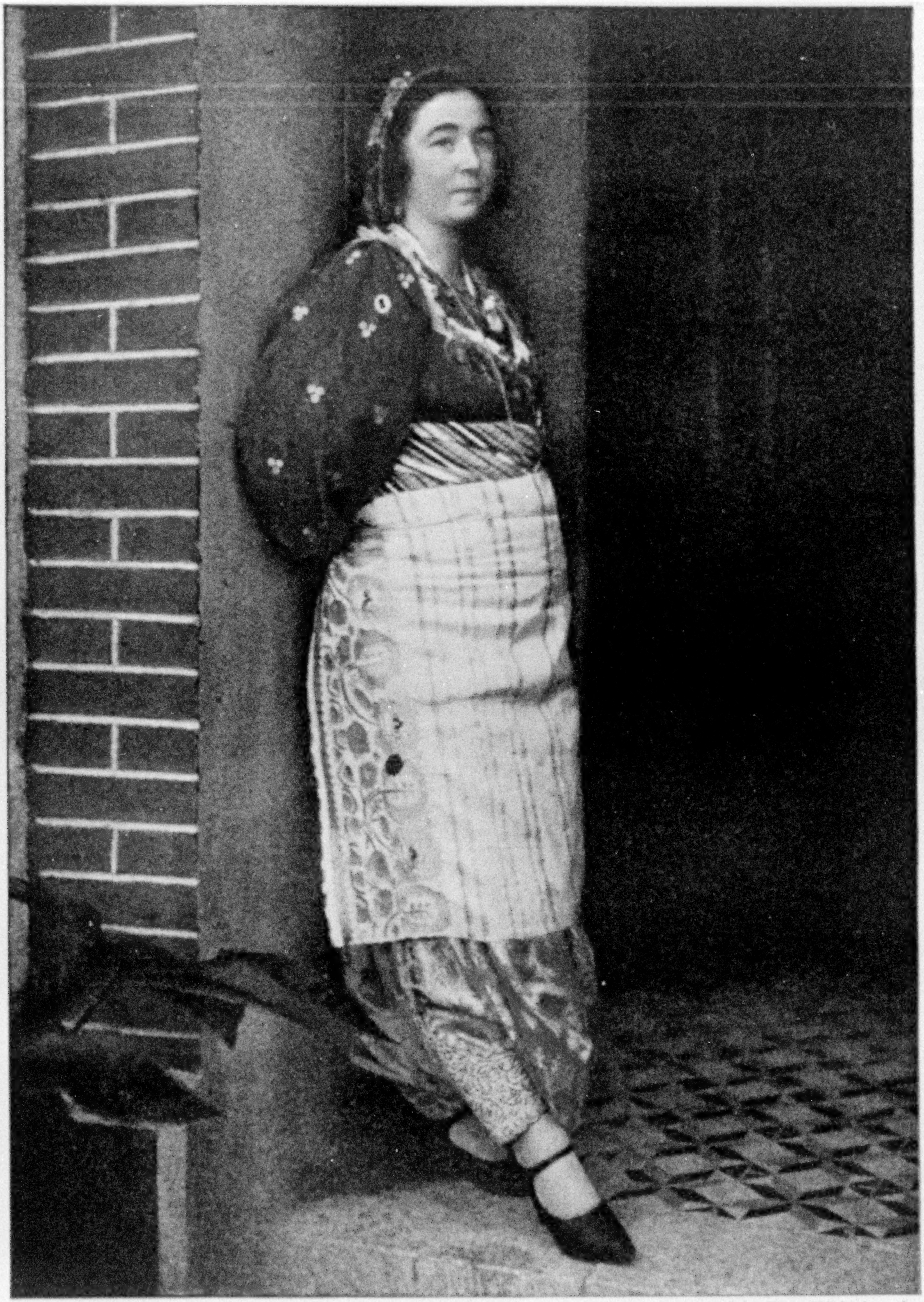
PRIMITIVE FARMING METHODS PERSIST

After many hours' passage across the Serbian plain, one is left with the impression that it alone might suffice as the granary of Jugoslavia's 13,000,000 people. On the other hand, one is constantly amazed at the primitive condition of a farming folk who were among the initiators of agricultural coöperatives.

The Serbs' native adaptability to coöperatives may in part be due to their traditionally small (20-acre) farm holdings. Even more it may be traceable to the *zadruga,* under which time-honored arrangement married sons or sons-in-law simply "built on" to the patriarchal dwelling until a family of perhaps sixty might be living beneath one roof.

At any rate, the Southern Slavs' history has been bound up with the soil ever since, in the 6th century, they poured down from Poland, Galicia, and the Carpathians. Gradually they spread westward and southward, lured by the fertile plains of future Jugoslavia. But the little agricultural kingdoms of the Croats and Slovenes passed out of the picture when the Magyars arrived. Of the three Southern Slav branches, the Serbs alone remained independent, developing under the Nemanyich dynasty toward a comparatively high cultural level in architecture, law, and literature.

Foreigners are few and obvious in that corner of South Serbia where well-garrisoned Skoplje faces the Greek and Bulgarian frontiers. Mysteriously enough, Skoplje had been apprised that four foreigners would descend from the 3:42 train. When a smart military aide stepped up as we stepped off, we were rather doubtful whether his greeting in Serbian meant, "Welcome to our city!" or "Welcome to



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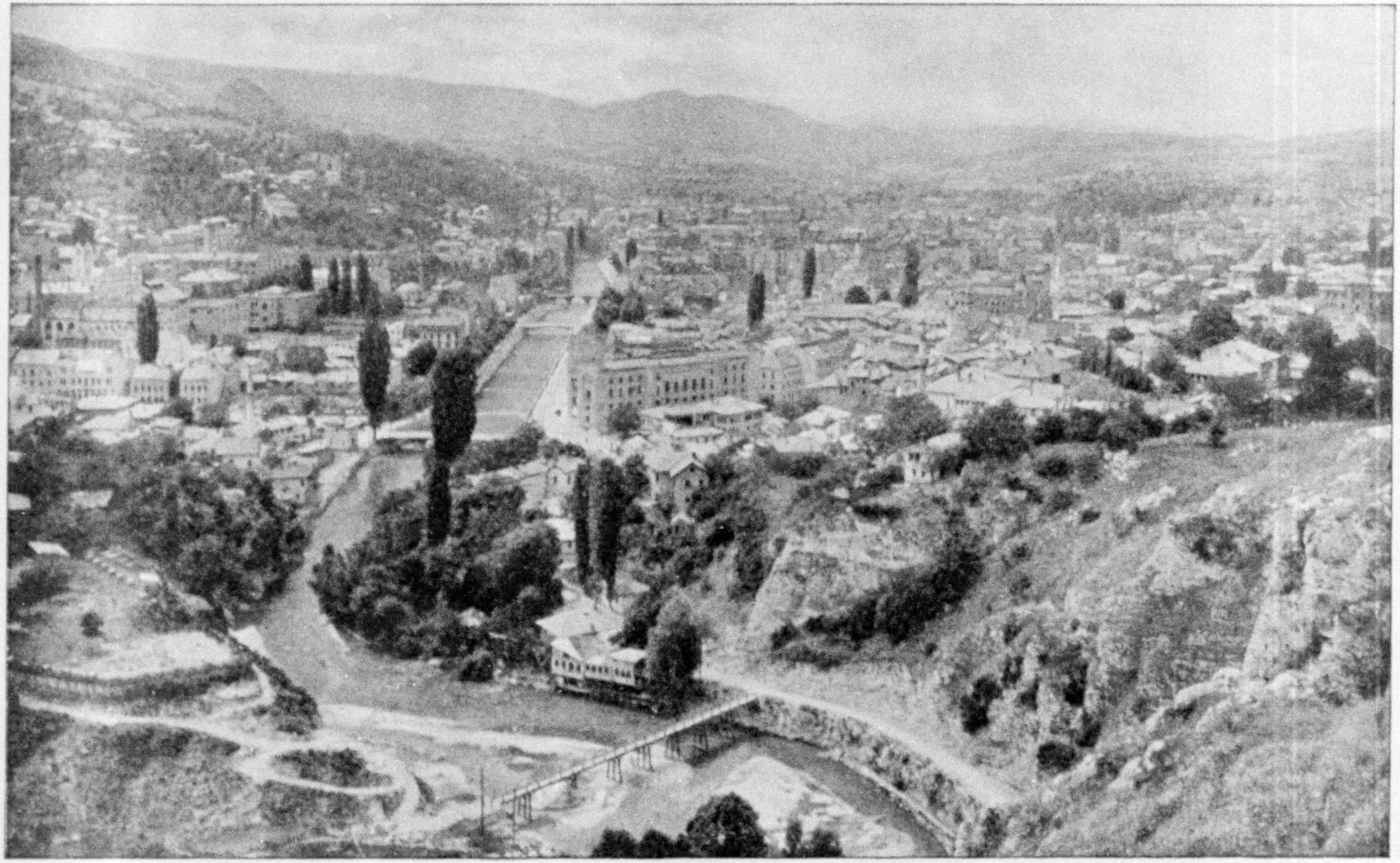
A LADY OF PRIZREN'S FOUR HUNDRED

Here costumes still show the influence of those days not so long past when ladies of the pasha's harem set the styles in feminine attire.



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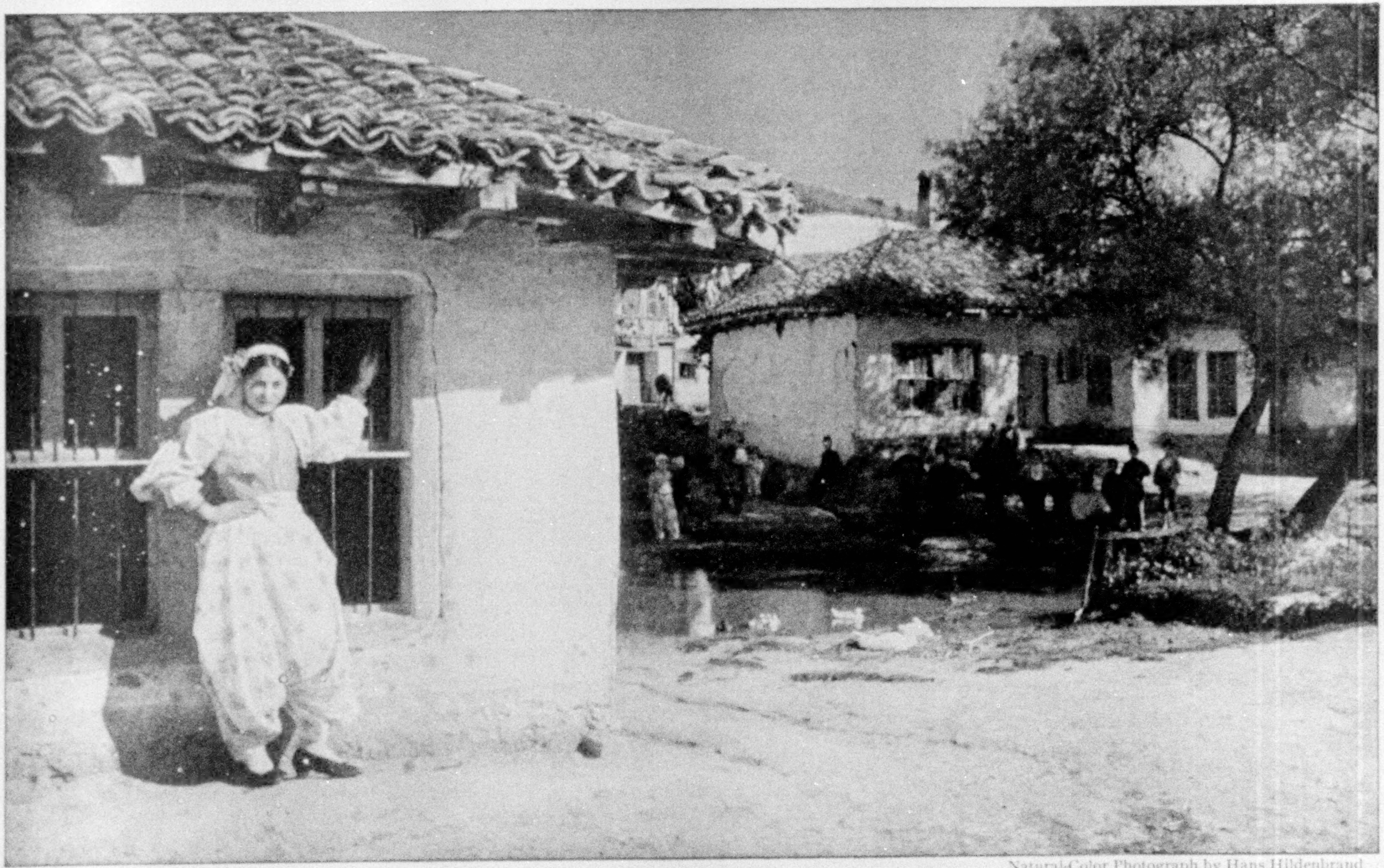
AT SARAJEVO WAS STRUCK THE BLOW THAT SENT A WORLD TO WAR

Here, in July, 1914, the Austrian Archduke Francis Ferdinand and his wife were assassinated by a fanatical student. The events that followed resulted in declarations of war by most of the great nations of the world. It was just before crossing the last bridge visible in the picture that the Austrian visitors were killed. The attractive city that is Sarajevo of to-day is replacing an older community cast from the Turkish mold.



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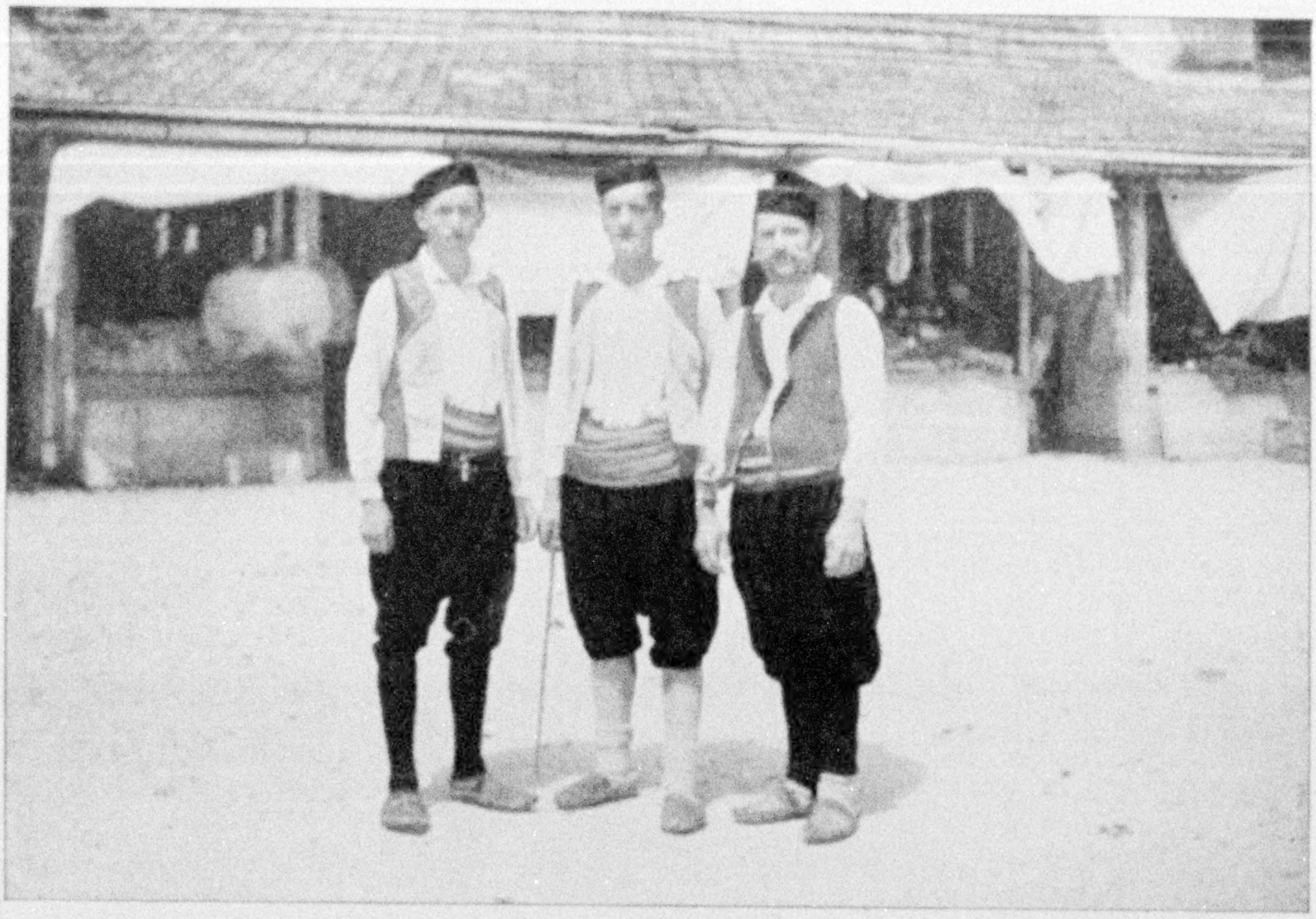
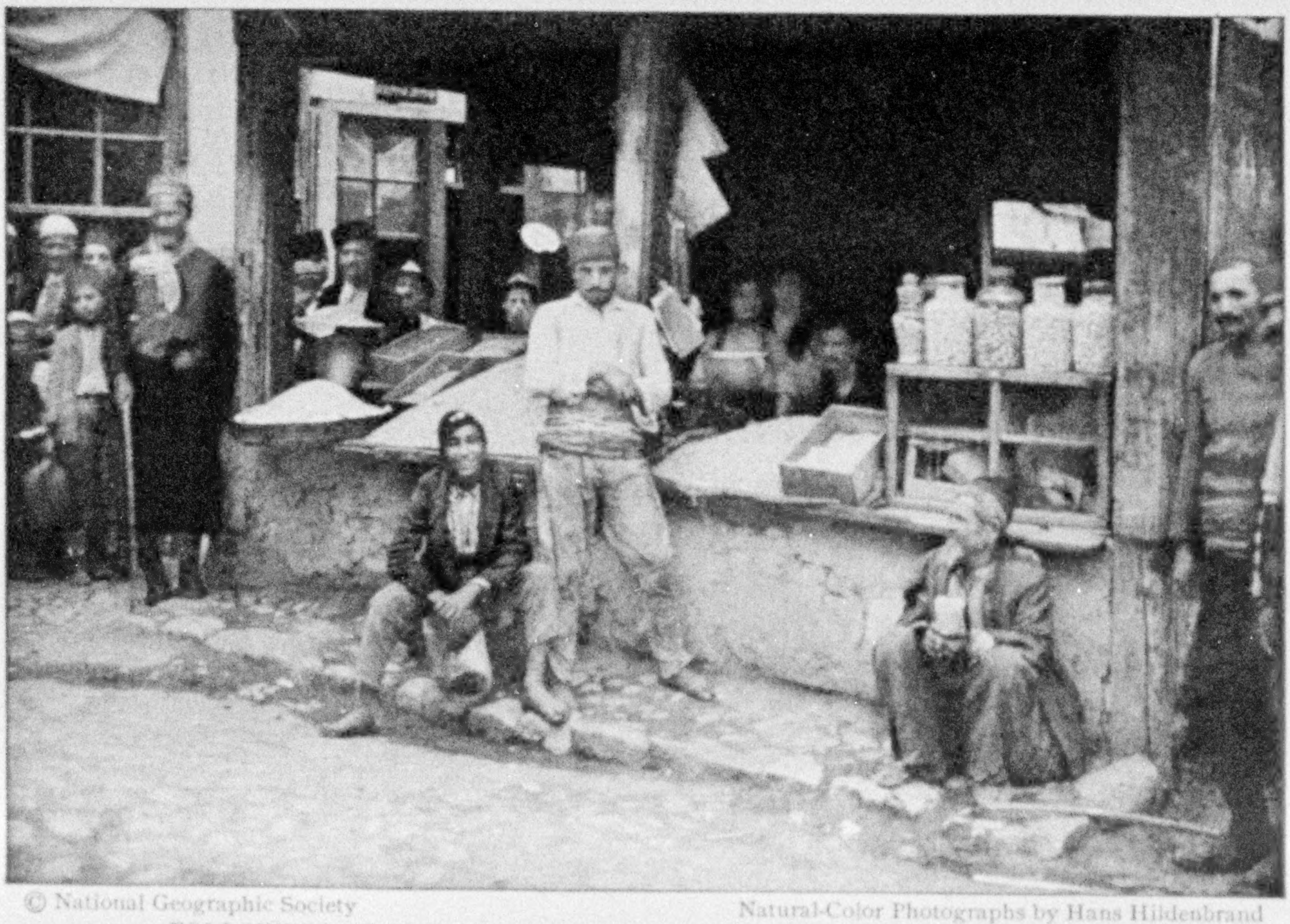
GYPSIES ARE NUMEROUS IN THE LANDS OF THE SOUTHERN SLAVS

Unlike their brethren in most other parts of the world, these gypsies are not nomads and generally have at least semi-permanent homes. They frequently inhabit the suburbs of the cities and follow agricultural pursuits for a livelihood. To augment their incomes, many of them play in bands and orchestras at night. The girl is from a gypsy settlement near Priština, a town of Jugoslavia.



THEY DWELL NEAR A CRADLE OF BALKAN LIBERTY

Hercegovina is a land of rocks and mountains and remote valleys. Its people are confirmed nationalists and repeated foreign oppressions have failed to dim the spirit of liberty among them. Peasants from the Breno Valley in the marketplace at Trebinje.



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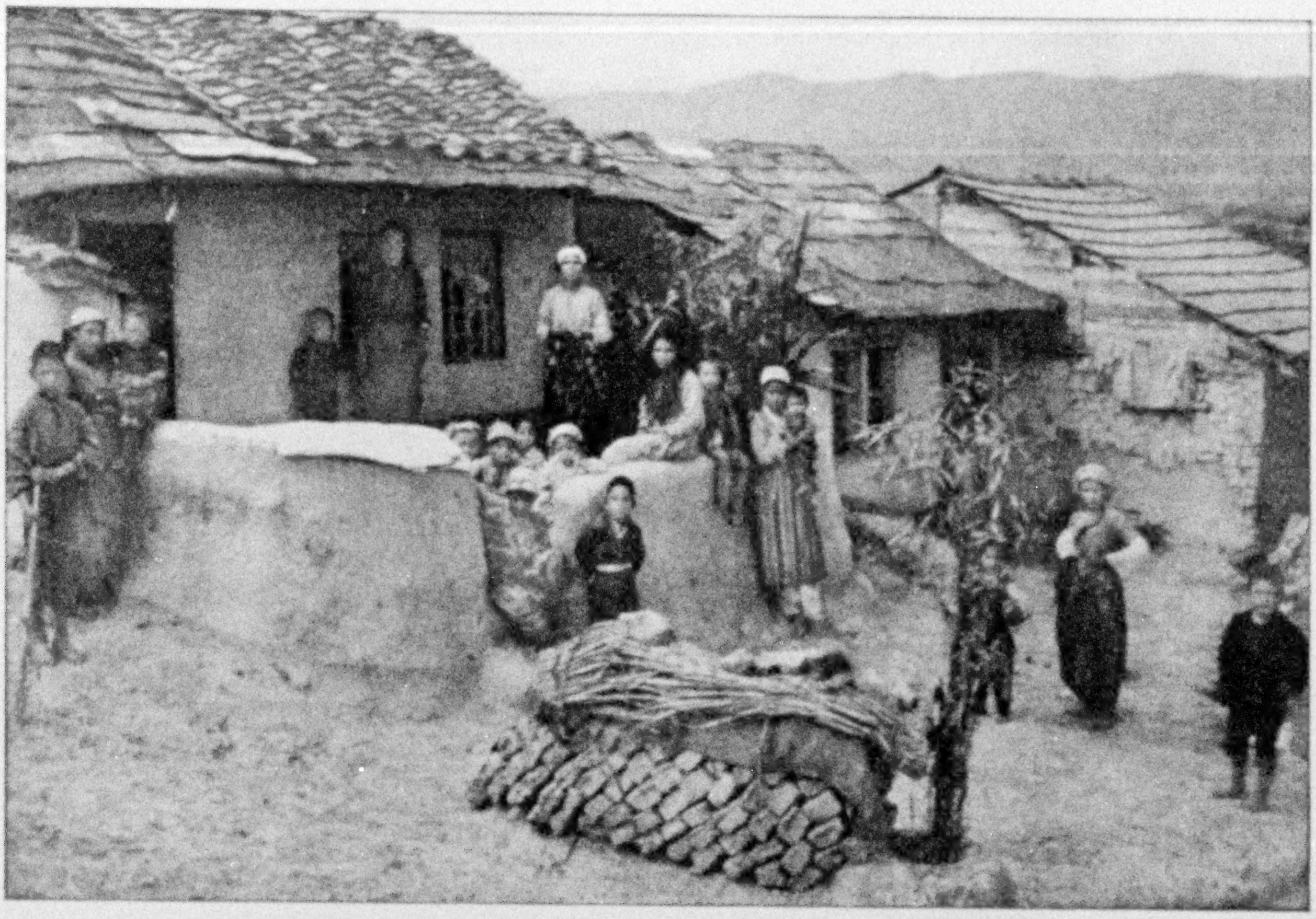
FOLLOWERS OF THE CROSS AND CRESCENT MINGLE PEACEABLY HERE

Christians and Mohammedans experience little difficulty in living together harmoniously at Skoplje. This town, which is fast developing into a metropolis of the new South Slav Nation, has a large Mohammedan population.



SONS AND DAUGHTERS OF ROMANY

So great is the Serbian gypsies' love of music that their violins accompany them wherever they go. The gypsy soldiers on occasions have even taken the instruments into battle with them. The wood stacked in the yard has a covering of straw to keep it dry.

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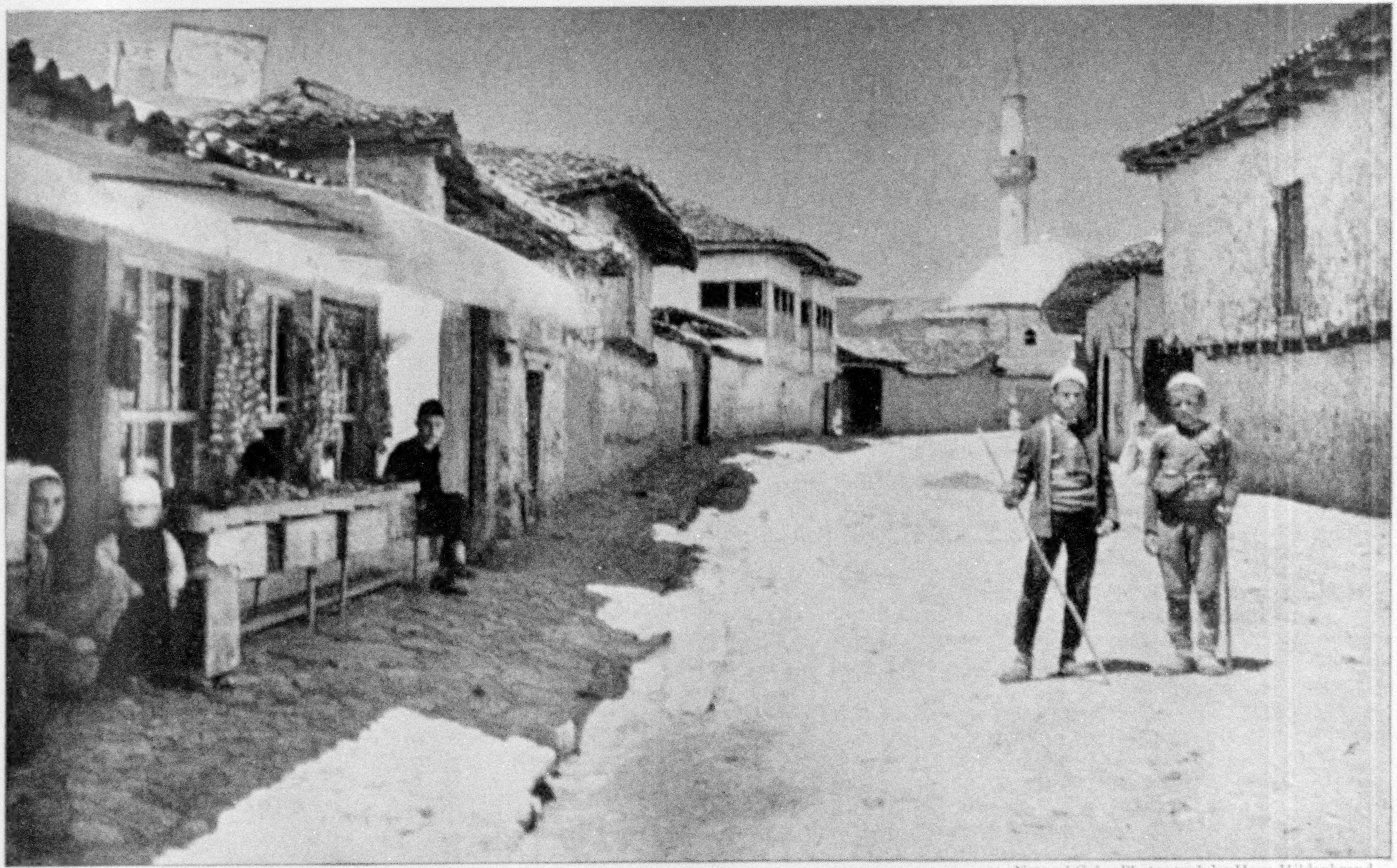
REMINDERS ARE FREQUENT OF DAYS WHEN THE TURK RULED THIS LAND

Many of the buildings of southern Jugoslavia are of Moslem architecture and recall the fact that for five centuries Turkish power was supreme there. Except among the mountains, the climate is mild in this region and wood is largely used for fuel.



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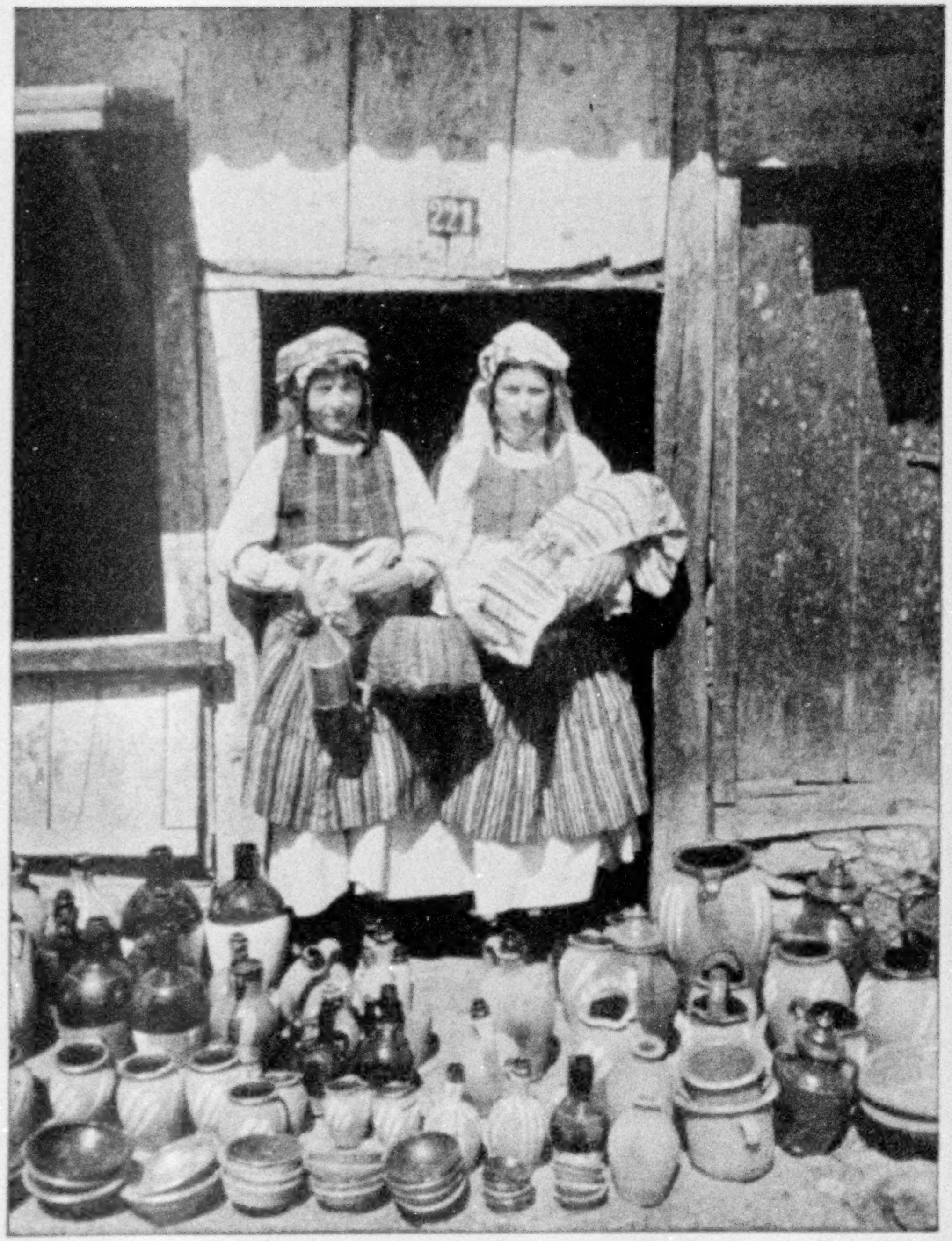
MANY OF PRIŠTINA'S STREETS COULD PASS FOR ASIAN BYWAYS

As in so many other parts of southwestern Europe, the minaret and skullcap are much in evidence. The two boys standing in the street are Albanians. Note the strings of onions hanging by the windows. The Serbs are high seasoners, with a special fondness for paprika and onion.



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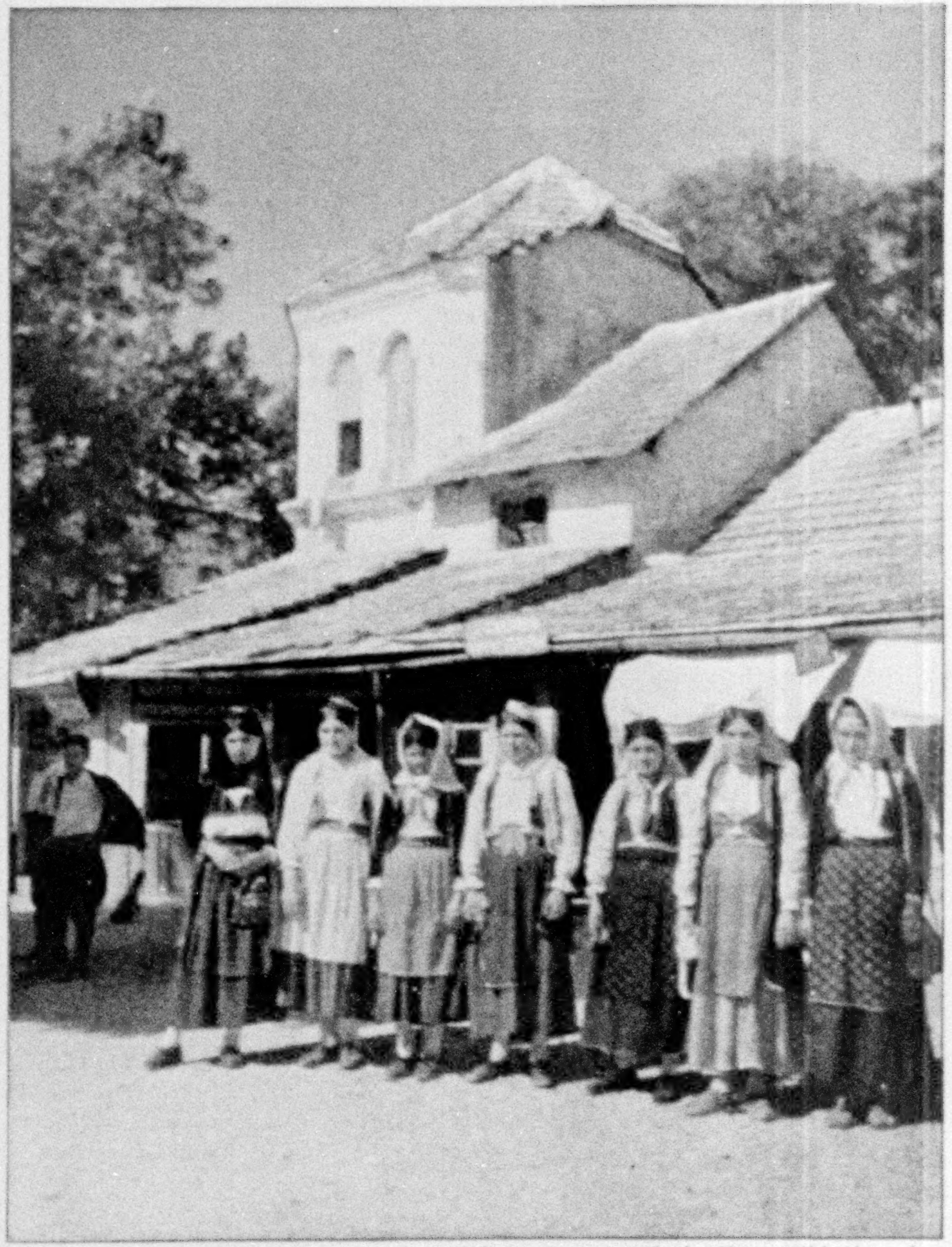
PRODUCTS OF THE PEASANT POTTER'S WHEEL

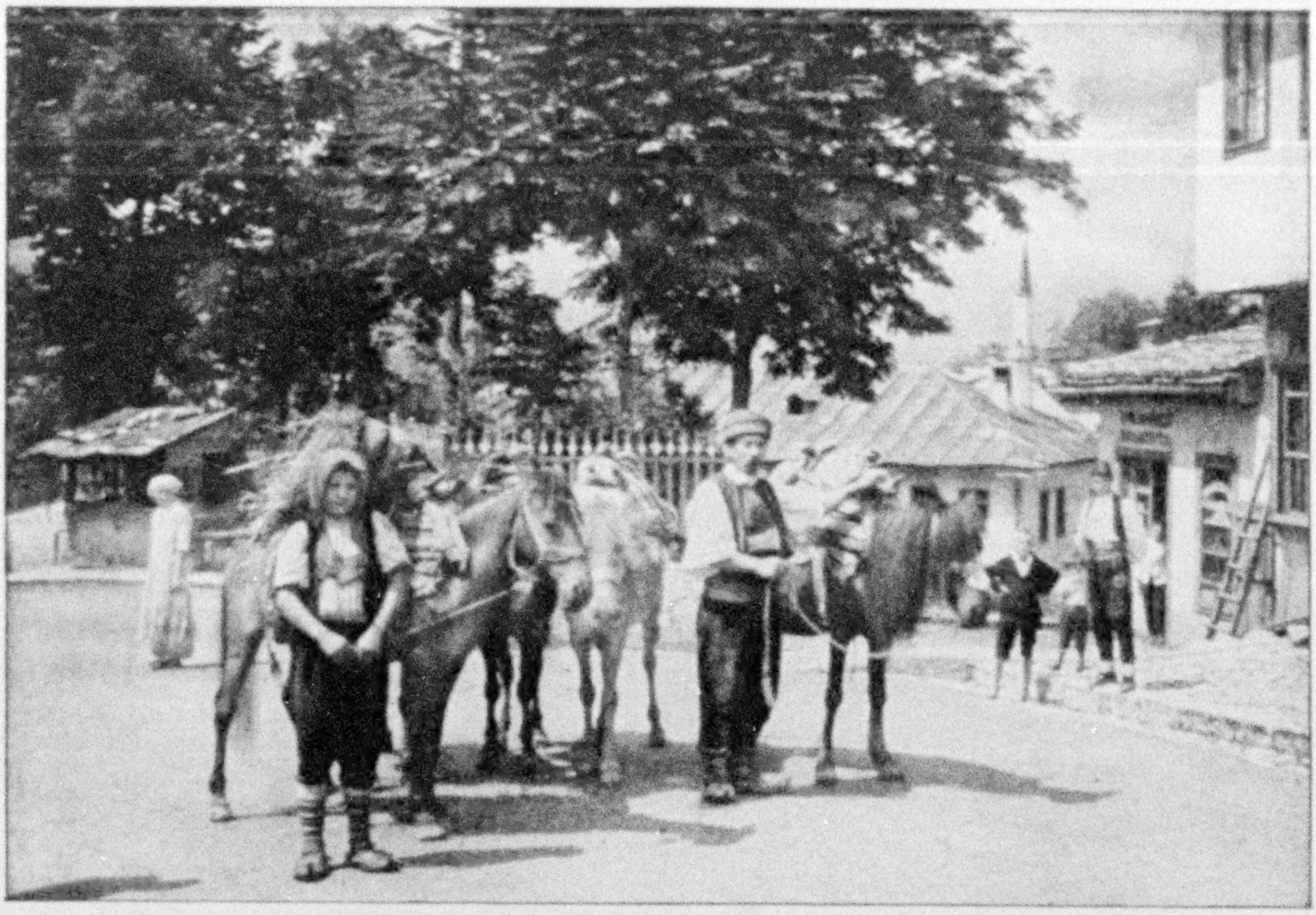
While the ceramic industry in Jugoslavia is not of great importance commercially, people of the small towns and countryside are proficient enough at the potter's art to satisfy most of their own needs.



Natural-Color Photographs by Hans Hildenbrand

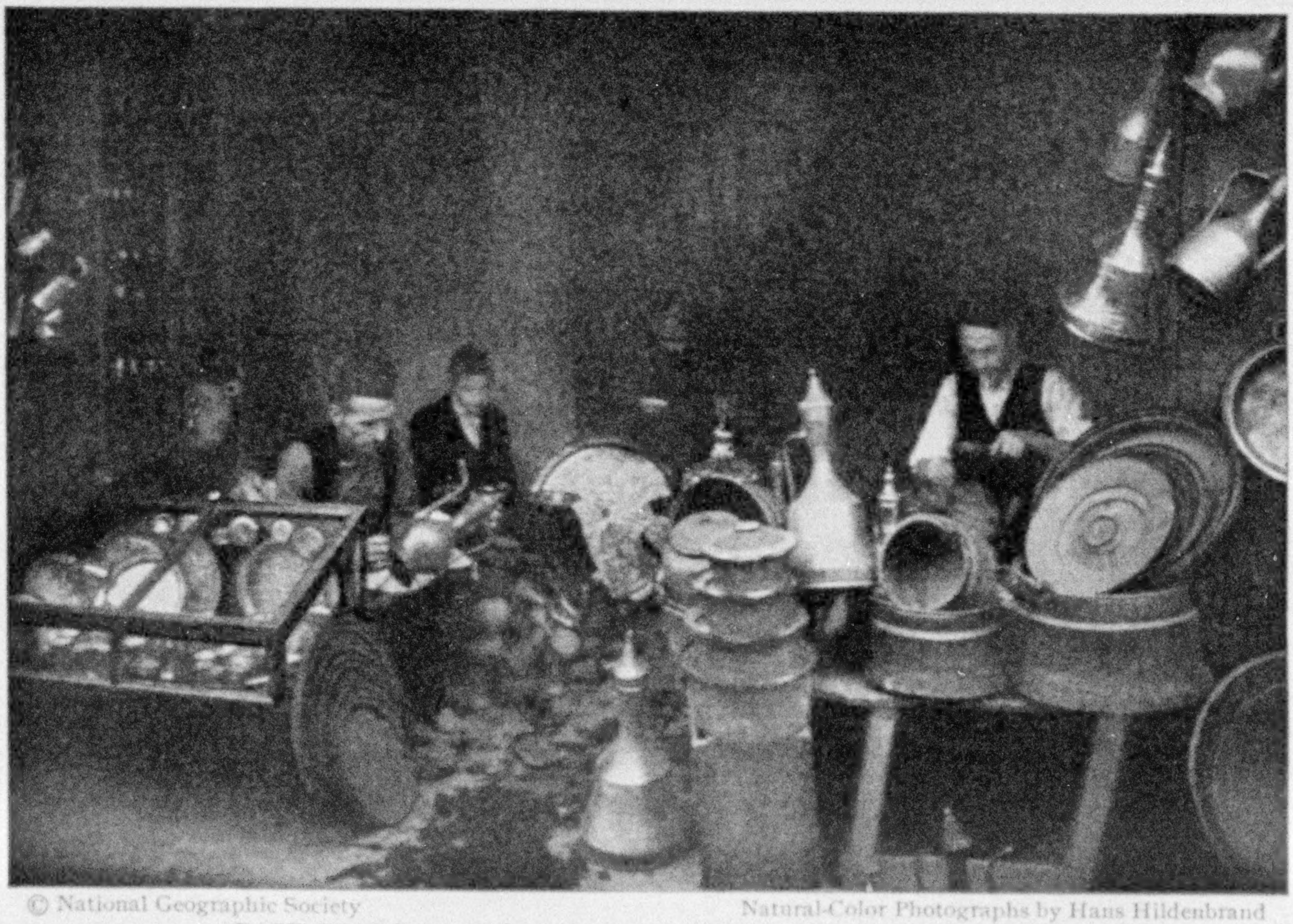
HERCEGOVINIAN GIRLS IN GAY ATTIRE

Peasant women of Trebinje bedeck themselves elaborately for market days, when they bring to town peaches, pears, cherries, apricots, grapes, tobacco, and other products of orchard and field.



HORSES PLAY A MAJOR RÔLE IN BOSNIA'S ECONOMIC LIFE

Land holdings are small here and each peasant works his own farm. His horses are strong, sure-footed, and docile. The sturdy little animals also serve with mountain artillery units.



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EACH TRADE HAS ITS OWN STREET IN THE BAZAAR QUARTER

A large number of the people of Bosnia are Mohammedans and the customs of the East are woven into their daily life. Their fezzes indicate that these coppersmiths of Sarajevo are Moslems.

our jail!" And we were personally conducted to a hotel and personally deposited in separate bedrooms while still wondering if these attentions augured fetters or flowers.

Our minds were set at rest, however, when we were annexed by a delightful Serbian colonel, who showed us Skoplje inside and out. More, he turned it for us into a tourist's paradise. No waiting on thresholds, no fights with cabmen, no trailing beggars! Upon his approach, doors flew open, mendicants scattered, cabmen kotowed; and if we as much as breathed a wish to photograph some wayside group, the colonel's aide would arrest and pose those startled individuals with commands that sounded like, "Halt! Eyes right! Stand at ease!" Then our cameras would click, and the aide would report to the colonel, and the colonel would nod, and the aide would shout (or so it seemed), "Company dismissed!"

EAST AND WEST UNITE IN SKOPLJE

Heterogeneous Skoplje! On one bank of the Vardar it struggles to be European, while on the other bank it remains Asiatic—without a struggle. On the one hand, something resembling a boom town, where marble edifice rears over jerry-built structure. On the other hand, a rambling bazaar quarter, containing in its medieval caravansary, its dilapidated mosques, its street types, its picturesque impermanency of aspect, all the characteristics of some ramshackle town in Asia Minor.

Furthermore, Skoplje rivals Rome in the matter of Roman aqueducts, and it can make the unique boast of having tamed 3,000 gypsies. At the close of the war this wandering inheritance from Turkish times was corralled by a nascent Jugoslavia and talked to paternally. "We'll give you some deserted houses and farms," said the authorities, "on condition that you don't travel." Now, that was rather like asking a fish not to swim. And yet—wonder of wonders—Skoplje's gypsies have "stayed put" ever since.

There they are, on a high, outlying ridge, occupying the typical Serbian cabins which overlook their little farms. You may behold gypsies at the plow, gypsies thatching roofs, gypsies keeping store. And there isn't a caravan in sight.

It wasn't hard to locate Gypsytown. Daylong it advertised itself from afar by a ceaseless pandemonium of screeching flageolets and thud-thudding bass drums. It sounded Cairene, as if every soul in Gypsytown were doing the stomach dance.

"A party? A wedding?" we asked our hotel keeper.

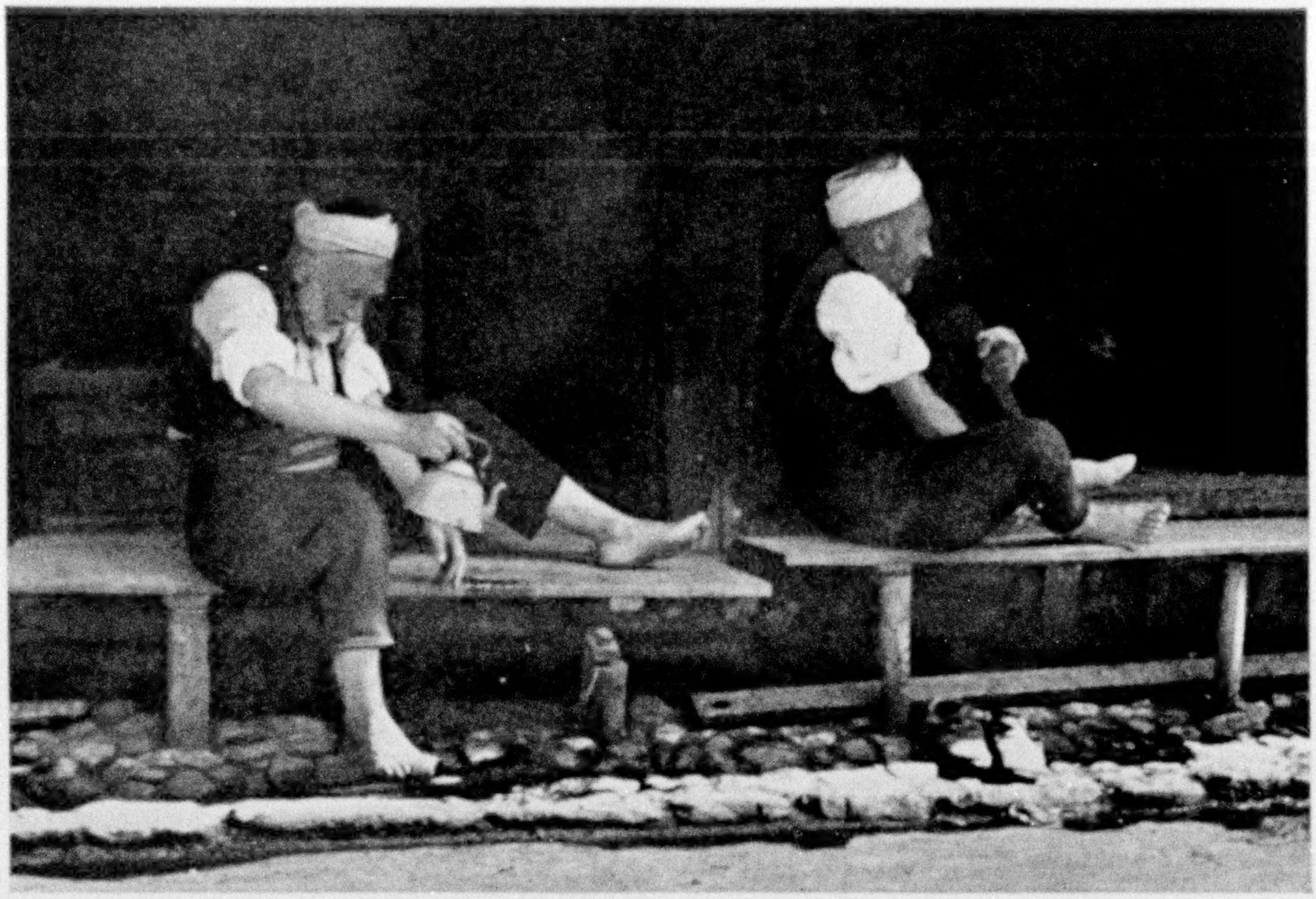
"No," he said. "They just get that way after they've worked steadily for awhile on their farms. You see, they're not allowed to travel, so they take it out in noise." By which we understood that the pandemonium was a kind of Freudian "transference."

We found them—the true, jet-eyed, dark-skinned, semisavage breed that delights in black elflocks and shriekingly colorful garb—seated on their doorsteps at lunch. In fact, they were all out-of-doors; and, though their little homes contained kitchens and tables, they still held to the beloved wayside fire. Yes, they were domiciled, but with a difference. Set the Romany patrin in their ways, and how many of the young ones wouldn't have disappeared on the long trail? As for their wrinkled elders, weren't they at heart like you frustrated, would-be wanderers of Gorgio stock, who "huddle and shut your eyes as the gypsy vans come through?" (see, also, Plates III, V).

MEMORIES OF STEPHEN DUSHAN LINGER ON THE SERBIAN PLAIN

To things pseudo-European, Turkish, Roman, and Romany add variegated Skoplje's evidences of late Byzantine times. In fact, the town is built around the crumbling hill fortress of Serbia's medieval hero, Stephen Dushan. There a parliament codified his laws into "Tsar Dushan's Book." There this champion of Christianity made head against Islam. There he was crowned under the sonorous title of "Emperor of the Greeks, Slavs, and Romans."

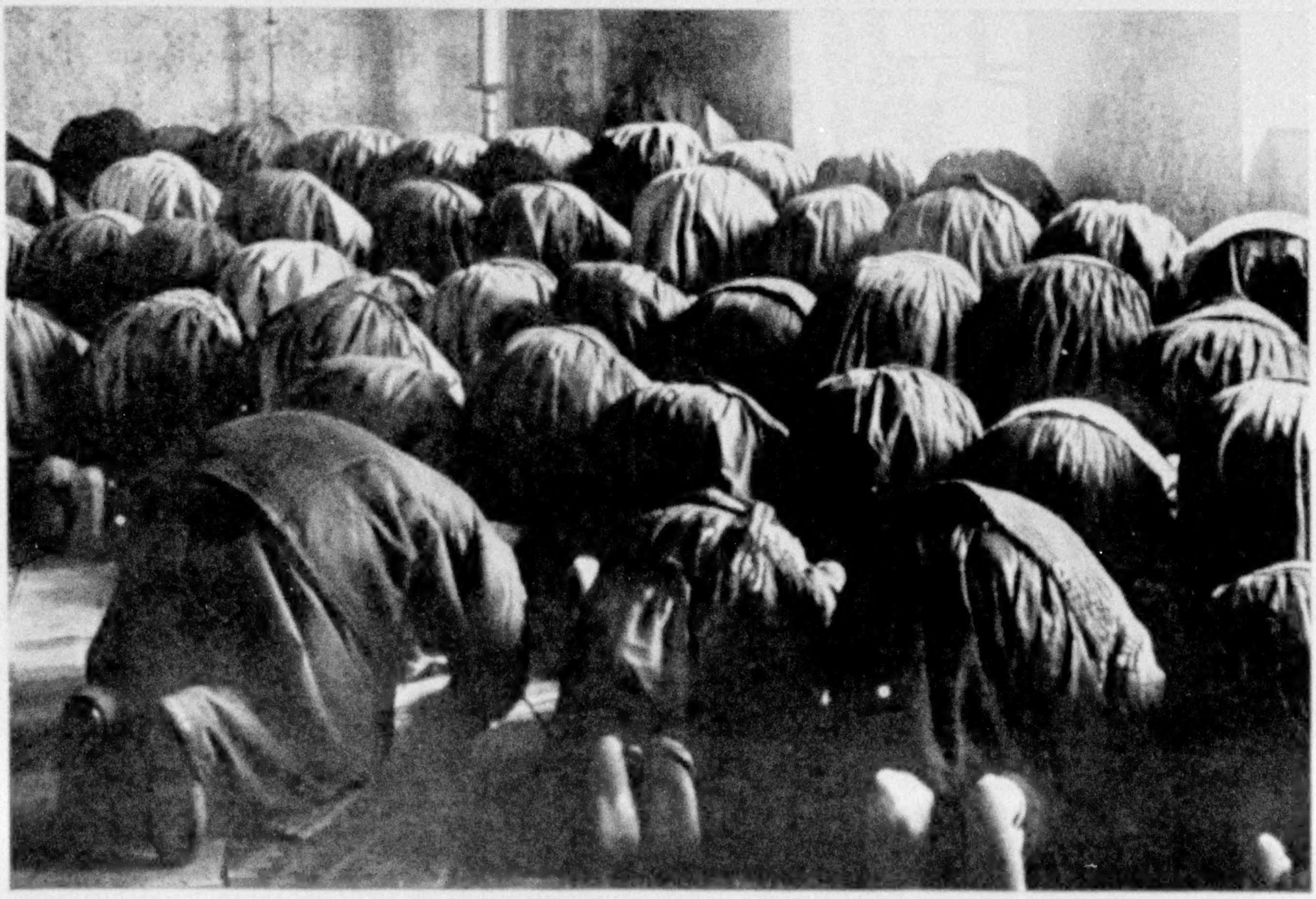
Throughout the Serbian plain the ghosts of Stephen and his Nemanyich ancestors still linger in many a faded fresco that panels the candlelit interior of medieval church or monastery. Priceless relics, these frescoes, of Byzantine art! Tall, slender, spiritualized, the Nemanyich kings and queens, aureoled with gold plaques, peer forth from dim blue backgrounds,



Photograph by Melville Chater

WHEN THE MUEZZIN CALLS, MOSLEM SHOPKEEPERS BEGIN FOOT-WASHING

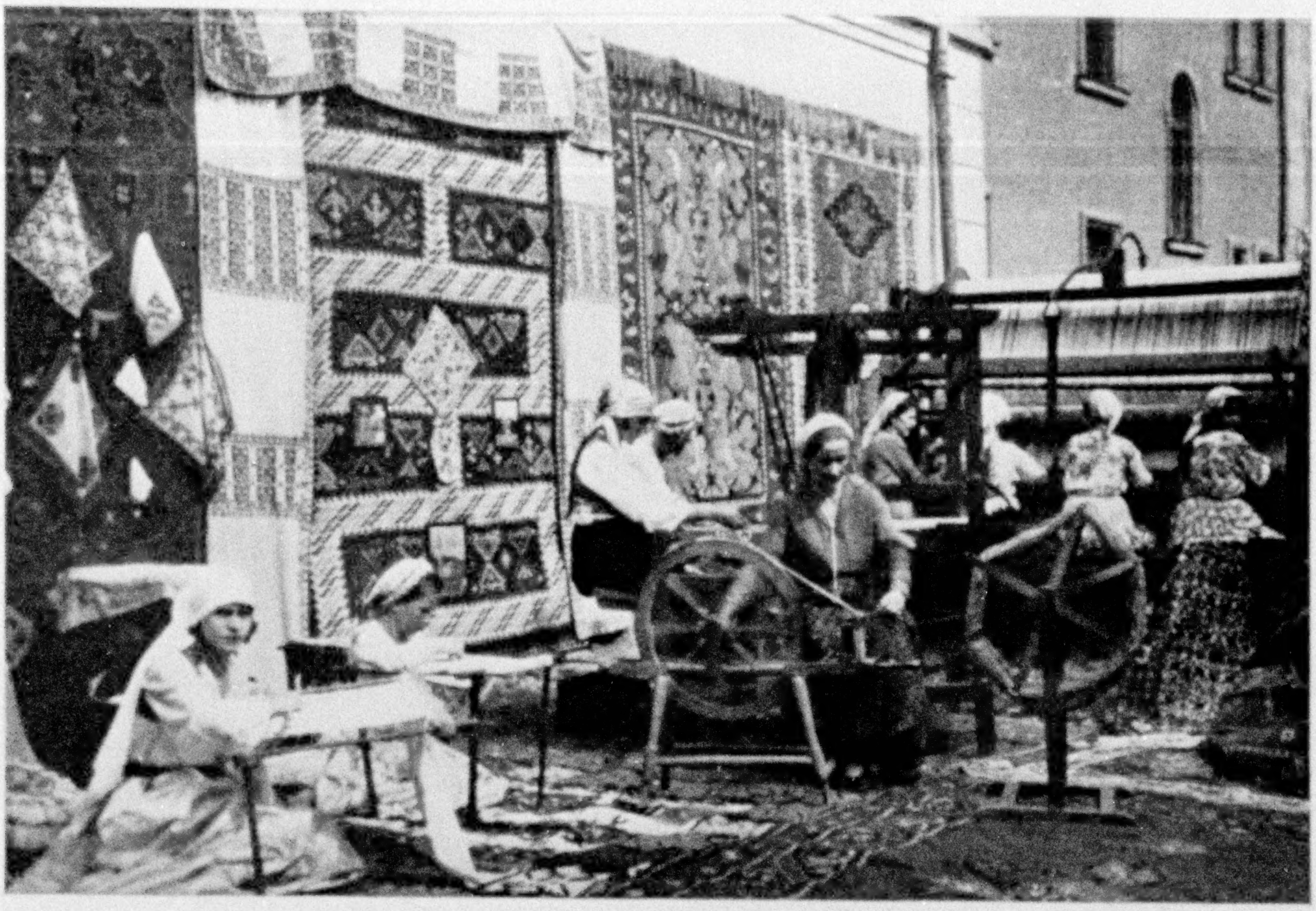
Since running water is required for the rite, the man on the left is about to pour a stream from a teakettle for his ablutions.



Photograph by Rudo Bruner-Dvořák

MOSLEMS PRAYING IN A SARAJEVO MOSQUE

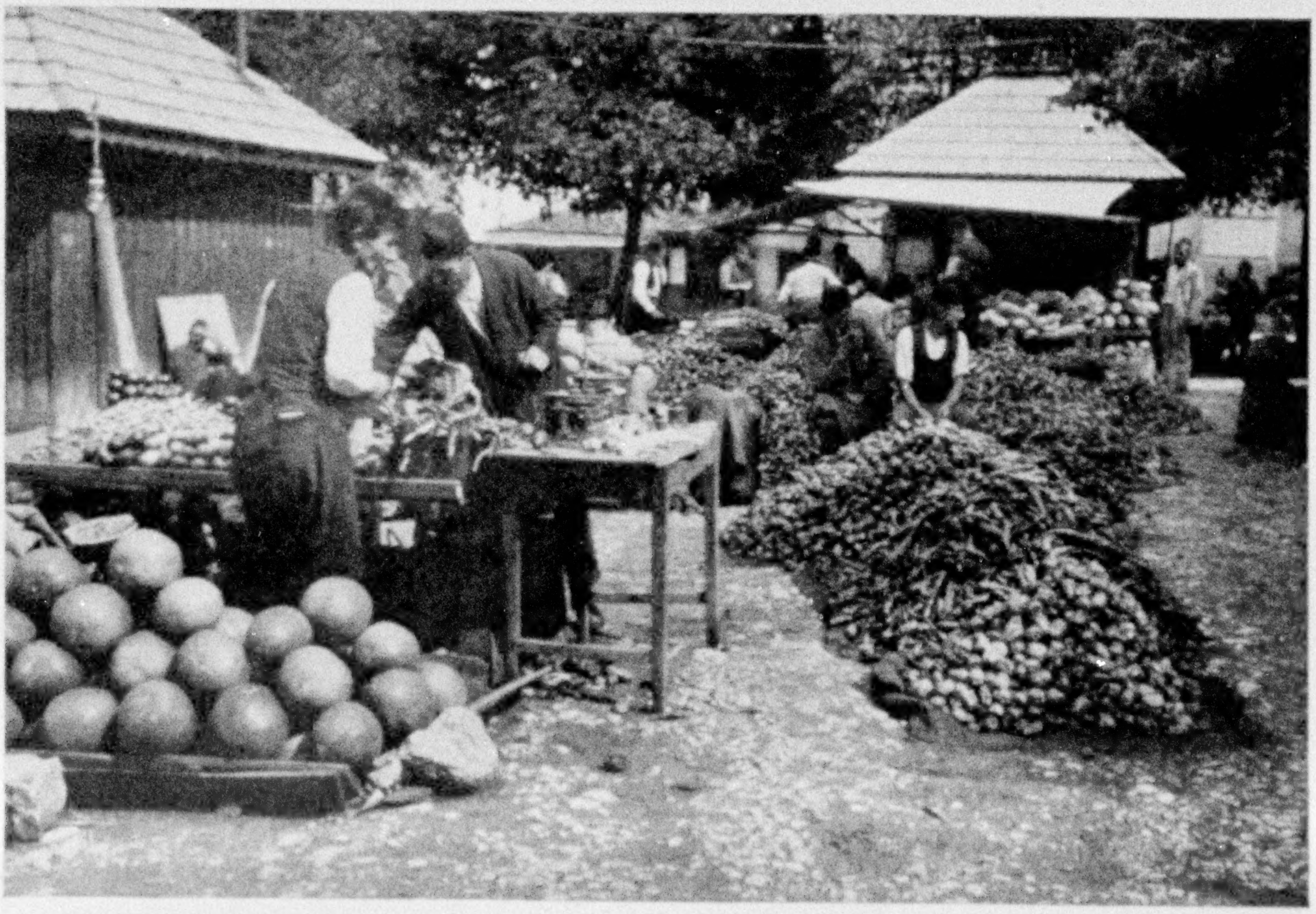
When the Turks invaded Serbia, many Christians yielded to Mohammedanism to escape forfeiture of lands. Descendants of these "converts" are to-day most devout in their adopted faith.



Photograph by Emil Mezer

FINE BOSNIAN AND PERSIAN RUGS ARE WOVEN AT SARAJEVO

Most of the workers in this factory, which is operated by the Government, are recruited from the Moslem population of the city (see illustration, page 265).



Photograph by Melville Chater

COOL MELONS AND HOT PEPPERS FOR SALE

The latter are as essential to the *lonac*, a popular dish throughout Jugoslavia, as onions to an Irish stew (see text, page 287).

Photograph by Emil Mezer

A FOUNTAIN IN THE OLD PART OF SARAJEVO

The visitor to the Bosnian capital is offered a most interesting variety of scenes. On the main streets he is in the midst of modern Europe, but the moment he steps into a byway he finds himself transported to the Orient. Just around the corner from the fountain from which these Moslem children are filling their Eastern water jugs he may come upon a place purely occidental.

regarding us with their oriental eyes. The queens' coin-strung headdresses and their gowns, inwoven with complex color designs, recall the Serbian peasant woman's adornments of to-day. The fork-bearded kings balance miniature cathedrals on their outstretched palms. Over each regal pair hover angelic hosts tendering scepters and crowns. Yes, Heaven itself was royalty's handmaid in those irretrievable days when kings indeed were kings.

Follow Serbia's sanctuaries northward from Skoplje and you come to the country's most fertile plain. It is the Kosovo Polje, sacred to every Serb as the battlefield where the Nemanyich Empire perished in 1389 (see, also, Color Plate XIV).

Five centuries later that plain, deep in snow, saw the tragic retreat of the Serbian troops and twice as many civilians, in escape from the German and Bulgarian forces' closing shears. Leaving a trail of 10,000 frozen corpses behind it, the half-starved army crossed drifted ranges of Albania and Montenegro, reformed on Corfu, and reëntered action on the Thessalonike (Salonika) front.

We caught the northbound Orient Express. Next morning we beheld distant Beograd (Belgrade) rise like a long peninsula between the meeting waters of the Danube and the Sava.

BEOGRAD HAS "GONE MODERN"

Jugoslavia's metamorphoses, as observed "ten years after," are nowhere more striking than at its capital. Even less than a decade ago Beograd was a semioriental town of low, flat aspect, with wooden pavements and with two-storied houses in the Turkish style. To-day it is preponderatingly a modern city of 340,000 people, having quadrupled its population in 18 years. Intent on westernizing itself with a multiplication of tall buildings, public facilities, smart shopping districts, it suggests the rapid evolution of some American industrial center (see, also, illustrations, pages 286 and 288).

Photograph by Melville Chater

SLOVENIAN LUMBERMEN HAVE CARVED A WATER NYMPH MASCOT FOR THEIR RIVER SHACK

It would be interesting to speculate if, after all, it is not the ladies who most strikingly reveal a city's changing order of life. Beograd has gone flapper, and it is only on market days, with the influx of peasants dressed in age-old styles, that one realizes that he is still in the land of coin-strung headdresses, toe-tilted sandals, and many-hued, ruglike aprons.

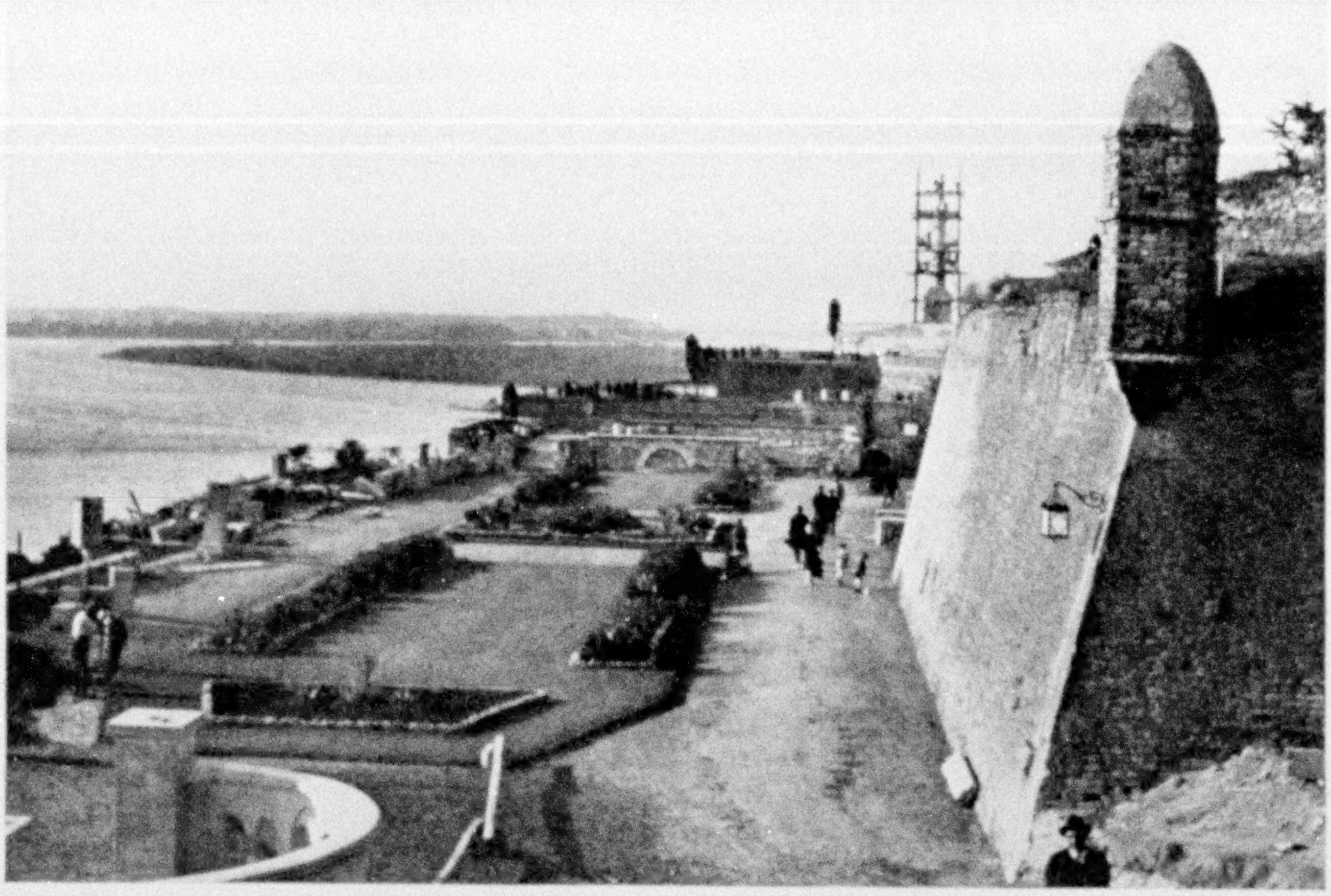
Sharply indeed the market-day stroller on Beograd's smart boulevards perceives how very recent is her occidentalization. Down the street come those rainbow-vying peasant women, bent under great yokes from which depend twin firkins of butter and cheese. Some Serbian Jack-of-the-Beanstalk, with his widowed mother's cow for sale, has hitched that animal, with her calf busy at the fount of nourishment, to an electric light standard. As for the threescore little Serbian pigs that went to market, they trot gaily along the sidewalk of that fashionable thoroughfare, in and out among a throng of silk-stockinged legs.

The spectacle of Beograd reconstructing herself is symptomatic of a nationwide process of exchanging old ways for new. Land hunger, that ancient urge which inspired the Southern Slav movement, has been largely solved by abolishing feudal privilege and redistributing feudal estates among half a million Jugoslavian families. Nowadays 140 acres is the maximum amount of land which may be held by an individual not actually cultivating it himself. And thus the Crown's initial proclamation, that "in our free State there can and shall be only free landholders," is well on the way to achievement.

Paralleling agrarian reform, there developed agricultural training schools, social legislation, and a coöperative movement on national lines.

Jugoslavia's coöperatives, with headquarters at Beograd, have become ramified into a vast organization which embraces practically all forms of food production and handcraft existing in the kingdom. Through some 785,000 members and their families, these coöperatives function beneficially for about one-third of the entire population.

Such measures as workers' health and accident insurance, the eight-hour day,



Photograph by Melville Chater

WHERE SAVAGE BATTLES RAGED, A PLEASANT PARK NOW INVITES STROLLERS

Here, at the confluence of the Sava and the Danube, some of the fiercest fighting of the World War took place, for Beograd was a city of great strategic importance. The ancient Serb fortress at the right sturdily withstood bombardments. In the background lies the island of Zemun (see illustration, page 288).

old-age pensions, and child-labor laws have been in operation since 1922-1924. Maternal-welfare legislation forbids the employment of expectant mothers during a period of four months and assures them free medical attention and against loss of work. As for baby, municipal *crèches* await him, and not the least joyous aspect of social legislation is seen at some industrial center like Zagreb (Agram), where, with sand piles, lunches, and games, the city functions *in loco parentis*.

LAURENCE RUNS AFOUL JUGOSLAVIAN LAW

We returned to Sarajevo to face the unpleasant news that our chauffeur had just been arrested. We gained admittance to where Laurence was undergoing head measurement, finger printing, and such like concomitants of crime. Indignantly we demanded of him what he had been doing to provoke arrest.

"Ketchin' me a mess of fish," returned Laurence sulkily.

"In jail for fishing?" chorused four skeptics.

"Yes, sir; jes' fishin' in a mean ole creek," he asseverated.

We sought out the authorities, learned the awful truth, paid Laurence's fine, and made our profound apologies. It would seem that Laurence, like ourselves, had been suffering from that well-known travel complaint, a longing for the dishes of one's own country. In our absence he had visited Ilidža, and while passing the State fish breederies had discovered a stream which he had mistaken as the natural haunt of certain speckled trout. In blithe innocence he had returned with rod and tackle and had whipped the stream to advantage. He had been apprehended with a fine string of Government trout in his possession, and arrest had followed.

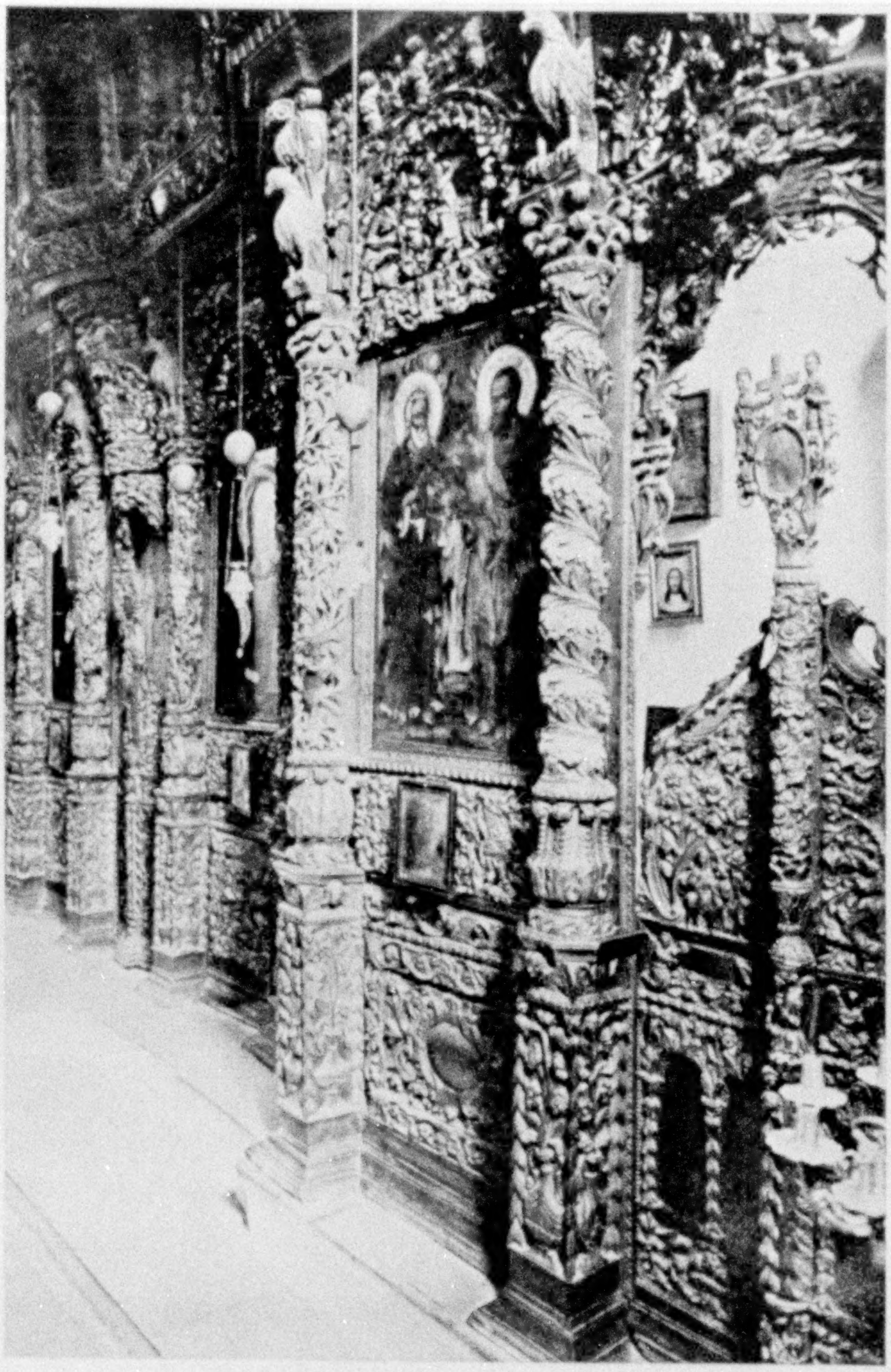
We got Laurence out of jail, then berated him for his stupidity in fishing on Government preserves, but he couldn't believe his ears. "Gov'ment *fish!*" he kept muttering to himself. "Dis ain't no free man's country. Never did heah yit of Gov'ment *fish!*"

A GLIMPSE OF A BOSNIAN FARMHOUSE

From Sarajevo we headed for Zagreb via the Plitvička Lakes. Now the rain-washed skies reappeared, a delicate blue overarching springlike pastorals throughout that green, undulating countryside of flocks, white cattle, picturesque peasantry.

Here was the simple Bosnian farmhouse—shingled, weather stained, chimneyless save for a roof vent—shaped like the house a child builds out of eight playing cards. Simple, too, its earth-floored bare-walled interior, with drying vegetables hung from the ceiling and the invariable hand loom in the corner. Venerable ancestor of the weaving mill, busily it click-clacks through long winter evenings, turning out clothing fabrics of intricate color design. Of wall paper, rugs, hangings, the Bosnian farm couple has no need. Gaily becostumed, they are themselves their own "interior decoration" (see, also, page 292).

Indeed, they are almost independent of the outside world. To supplement such home products as corn bread, garden truck, cheese, the butterlike *kaimak,* and Bosnia's inevitable peppers, they occasionally jaunt by oxcart for maybe twenty miles to some village store, where they purchase coffee, rice, and kerosene. Meat is confined to Sundays and holidays, when a barbecue takes place amid endless treading of the circle dance, performed to gypsy music.



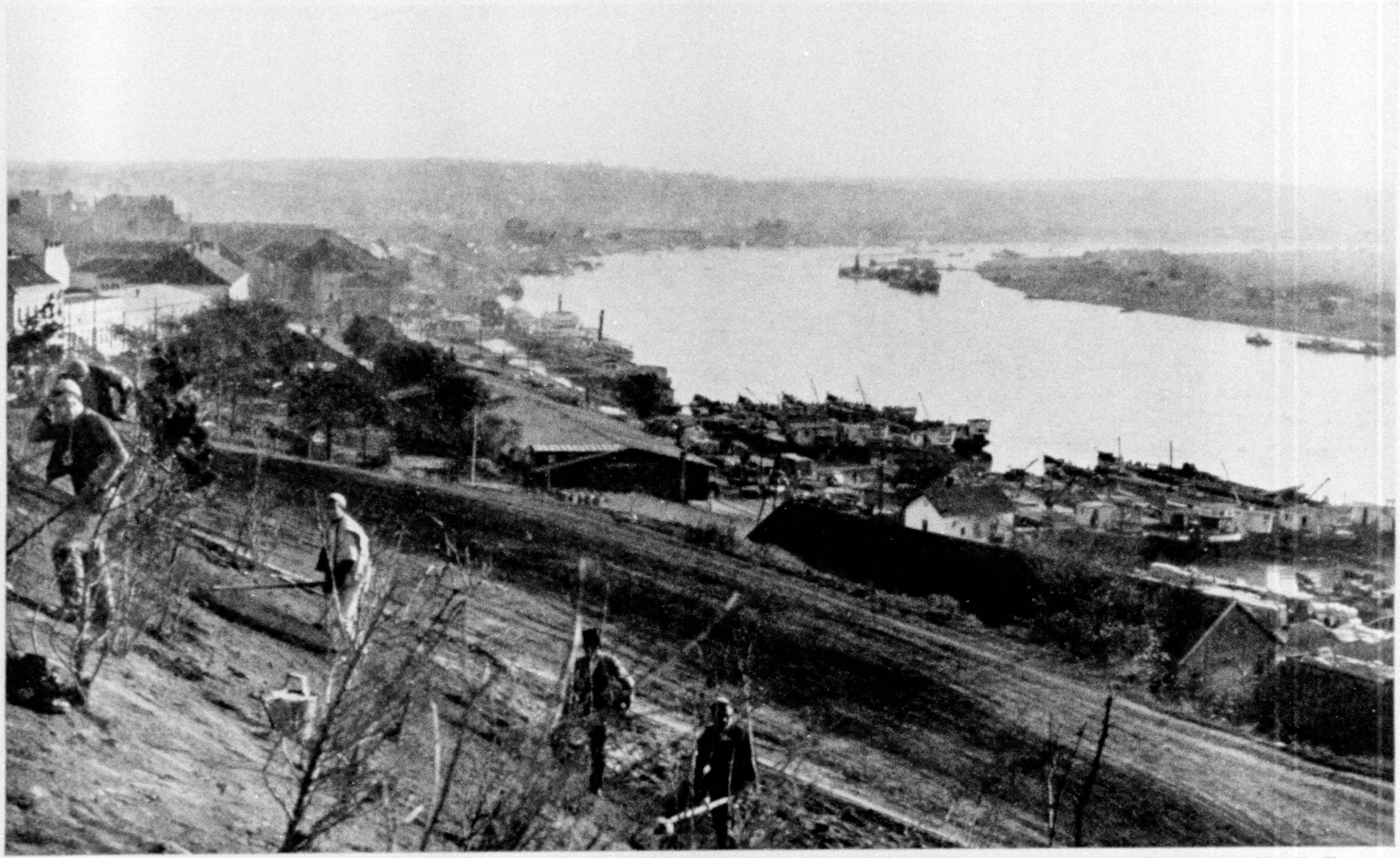
Photograph from Melville Chater

WOOD CARVING LENDS MEDIEVAL CHARM TO THE CHURCH AT SKOPLJE

The building is little more than a century old, but the decorations give it the appearance of antiquity.

THROUGH FORESTED HILLS TO THE ANCIENT SEAT OF BOSNIA'S KINGS

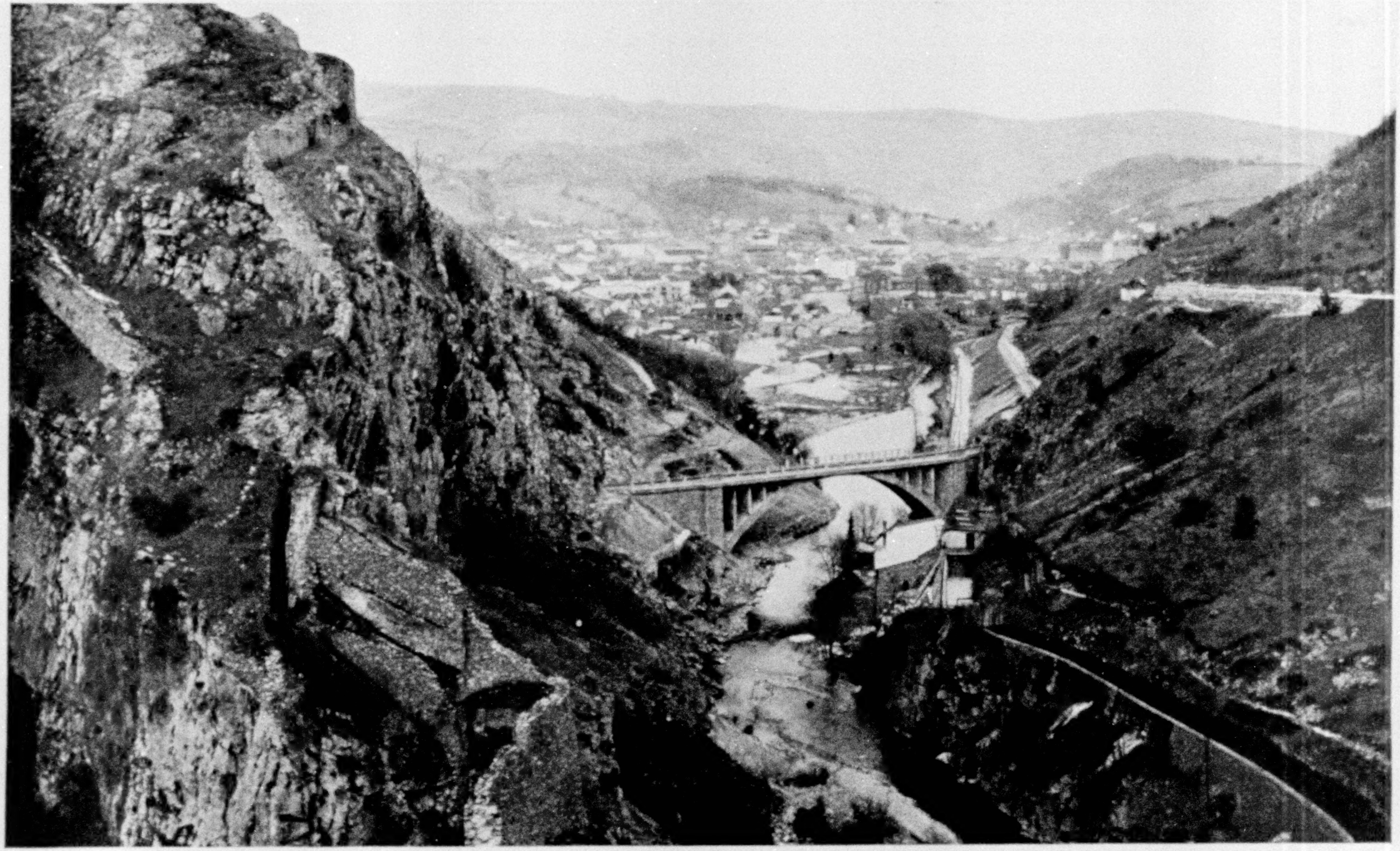
As for us, often dependent on village fare, we soon wearied of the ever-present *lonac,* which may be described as an Irish stew with a Slav education; and often we would catch Laurence's eye roving toward wayside hencoops in pursuit of his expressed aim to "get him a chicken" and



Photograph by Melville Chater

THREE TIMES DURING THE WORLD WAR HEAVY BOMBARDMENTS BATTERED BEOGRAD DOCKS

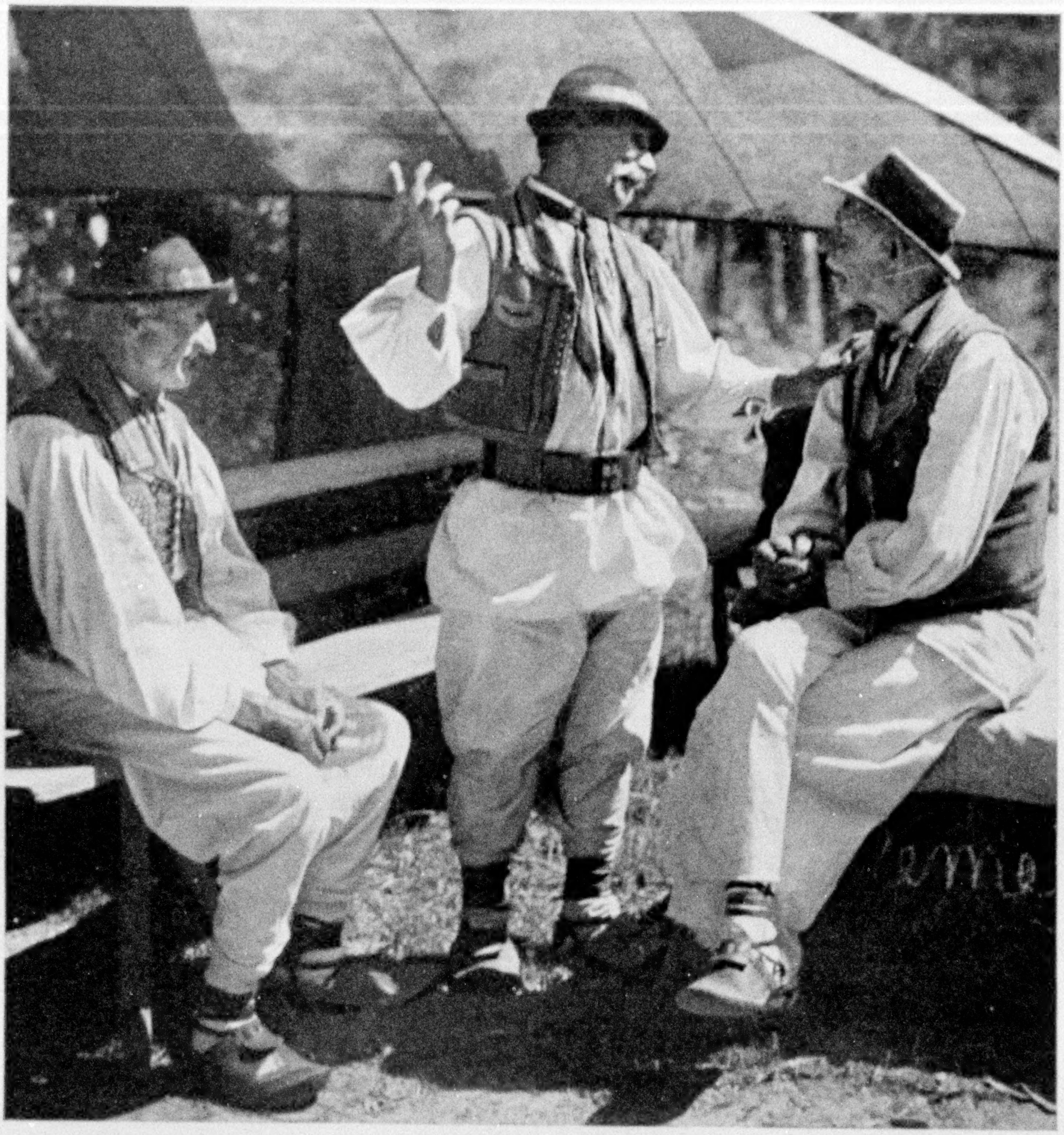
Shells flung across the Danube from the Austrian guns at Zemun, in the right background, tore the slope where these peasants are working. Courage and enterprise have removed most of the traces of the conflict.



Photograph from Melville Chater

WILD AND CRAGGY HILLS SURROUND UŽICE

Railroad building through this part of Jugoslavia presents problems of great difficulty. The town is connected with the main line between Beograd and Thessalonike (Salonika). The route from here to Sarajevo, to the west, is a triumph of engineering.



Photograph by Hans Hildenbrand

SETTLING THE AFFAIRS OF THE JUGOSLAV NATION

Wherever a few men come together, a spirited argument is sure to be carried on, for Jugoslavia represents a mingling of many racial groups. These three wear the typical summer clothing of their Croatian village. In winter they will put on heavy sheepskin coats over their embroidered waistcoats.

prepare it according to the ways of his native State, which is Maryland.

We climbed into a higher region of pine-clad hills, down which long chutes bore logs from distant camps to the brink of the gray-green Pliva. Winding along its sinuous course, we came to little hill-nestling Jajce, where the river gathers into falls that drop foamily into the rushing Vrbas.

Jajce, where Moslem minarets rise against the background of its ancient fortress remains, was of old the seat of Bosnia's kings. Enthroned among mountains and headwaters, they surveyed scenes of valley, gorge, and forest that still preserve a wild aspect as of centuries ago. A noble realm it was, made for hawking, hunting, and castle banquets. We agreed that it wouldn't have been half bad to week-end with the kings of Bosnia's tapestried past.

We entered the Tjesno Gorge, driving for four hours where the Vrbas's waters crested as rapids or subsided into trout pools, with always the canyon's gnarled

Photograph by Clara E. Sipprell

CROATIAN PEASANTS IN THE ZAGREB MARKET

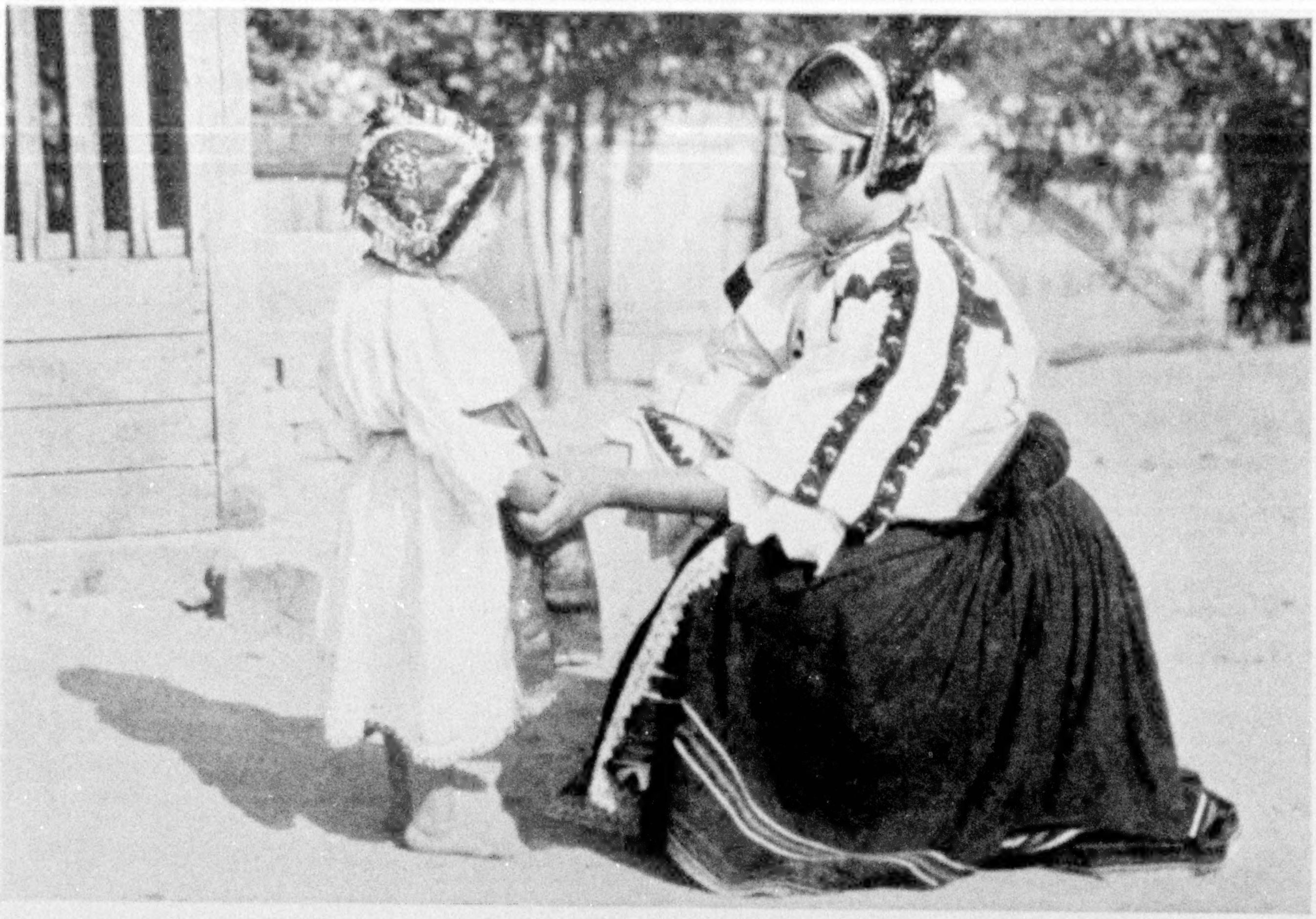
Although the city is growing rapidly and has all the modern smartness of populous centers elsewhere in Europe, some of the country folk still wear the national costume and barter their produce in the streets as did their ancestors.

sides looming above us, magnificently wooded to the river's brink. Here, as elsewhere, Bosnia's enduring charm lies in its sheer wildness of woodland and watercourse. Often one has to remind oneself that he is not traveling in some virgin country, but in one which has known settlement and conquest since the days of the ancient Thracians.

Emerging from the gorge, we came to a pretty, Turkishlike town of garden-surrounded houses, Banjaluka. Some smattering of philology caused us to suspect that the Slavic "banja" and the Italian "bagni" meant the same delightful thing—natural baths, where four travelers, long tubless, could luxuriate in thermal waters.

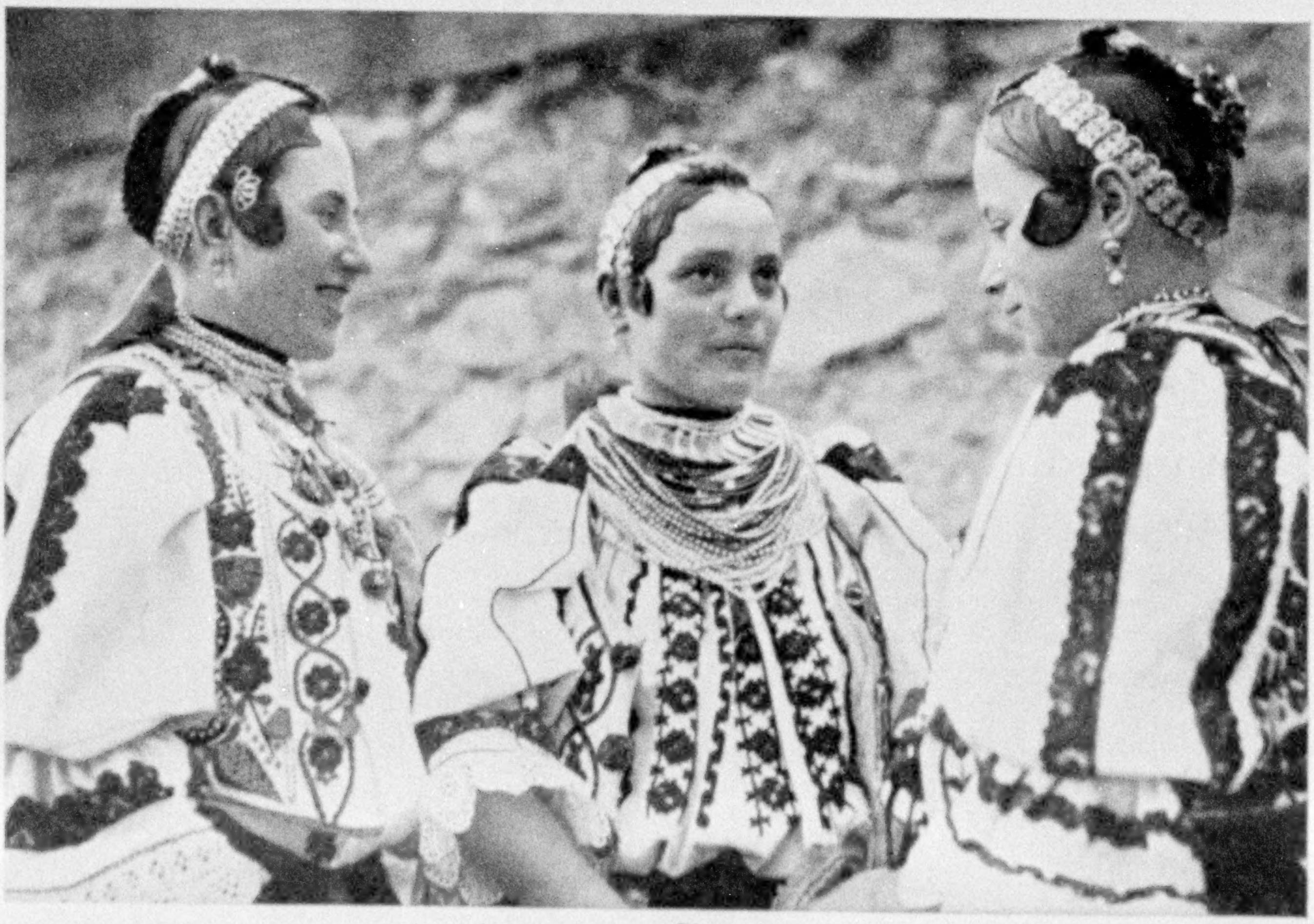
We questioned our hotel proprietor. He said: "Baths? I should say so. Very famous. Everybody visits them. Just follow along the river for two miles."

We prepared for this rare treat by furnishing ourselves with dressing gowns, sponges, rough towels, and some one even brought along a bottle of bath salts. Then we drove for the specified two miles and looked about us. Not a sign of a bathhouse! Nevertheless we kept on ques-



THE SOUTHERN SLAV MOTHER WEAVES HER OWN AND HER BABY'S CLOTHING

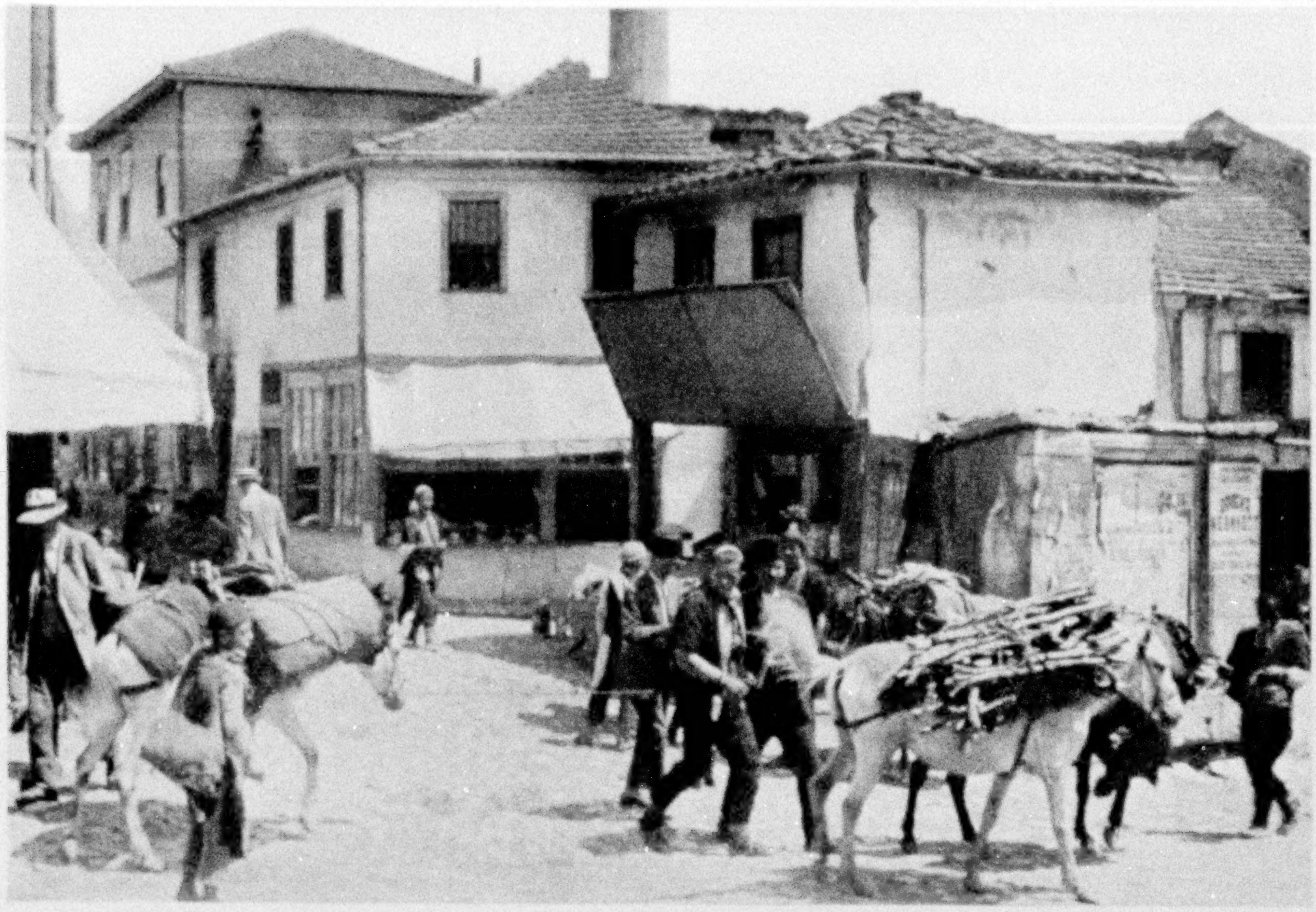
Weaving, embroidery, and linen manufacture are practiced by all of the women of the prosperous families of the Sava River region.



Photographs © Hungarian Press-Photographic Exchange

ODD COIFFURES AND RICH COSTUMES MARK CROATIAN WOMEN

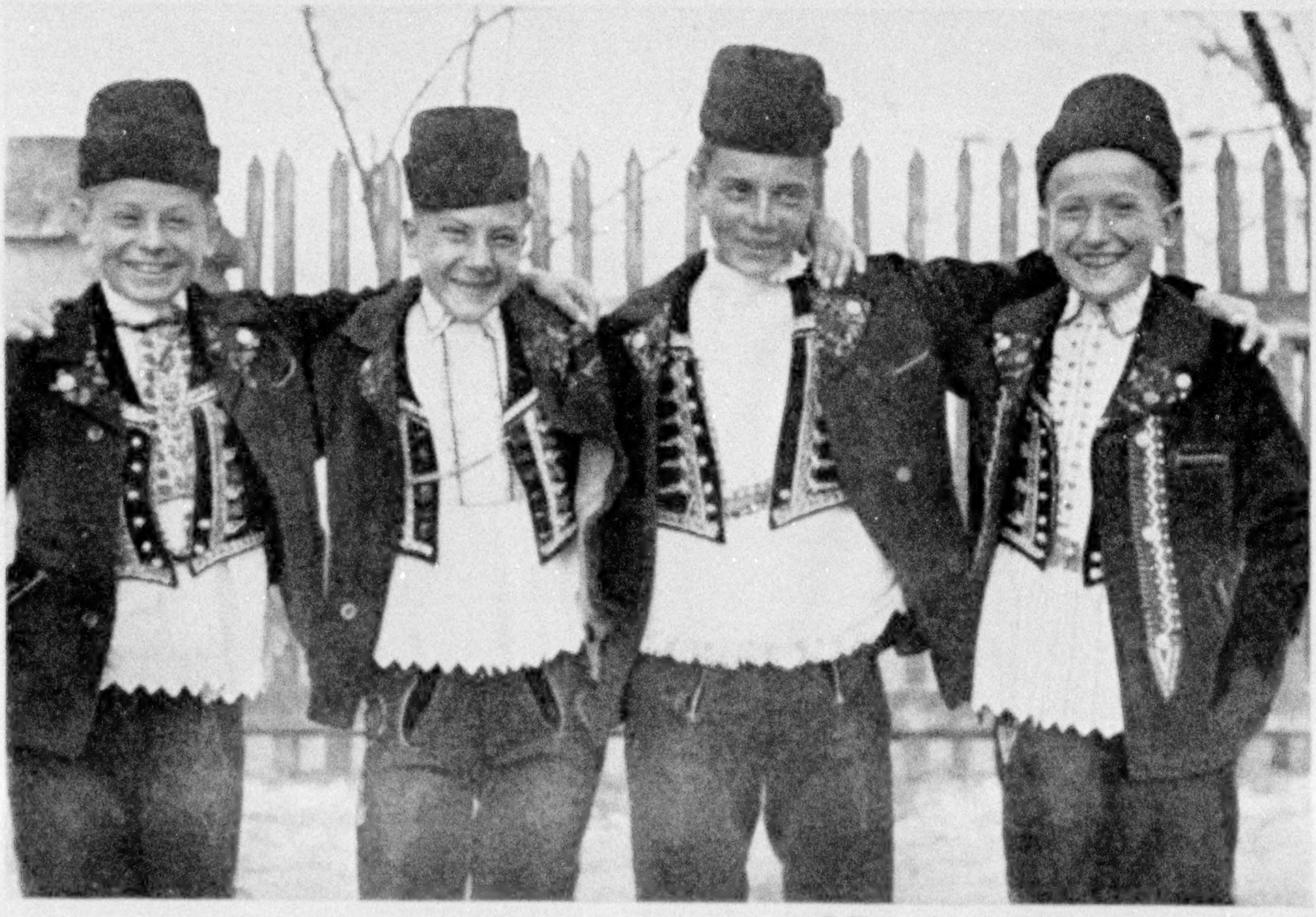
Needlework is far from a lost art among housewives of the prosperous families along the Drava River. Though well able to afford the best of modern dress, they continue to make their own strikingly individual clothing (see, also, Color Plate XV).



Photograph by Hans Hildenbrand

VENDERS BRING FAGOTS FROM THE HILLS TO SELL IN PRIZREN

Mules are the only available pack animals capable of scrambling through the rough country where the wood is cut.



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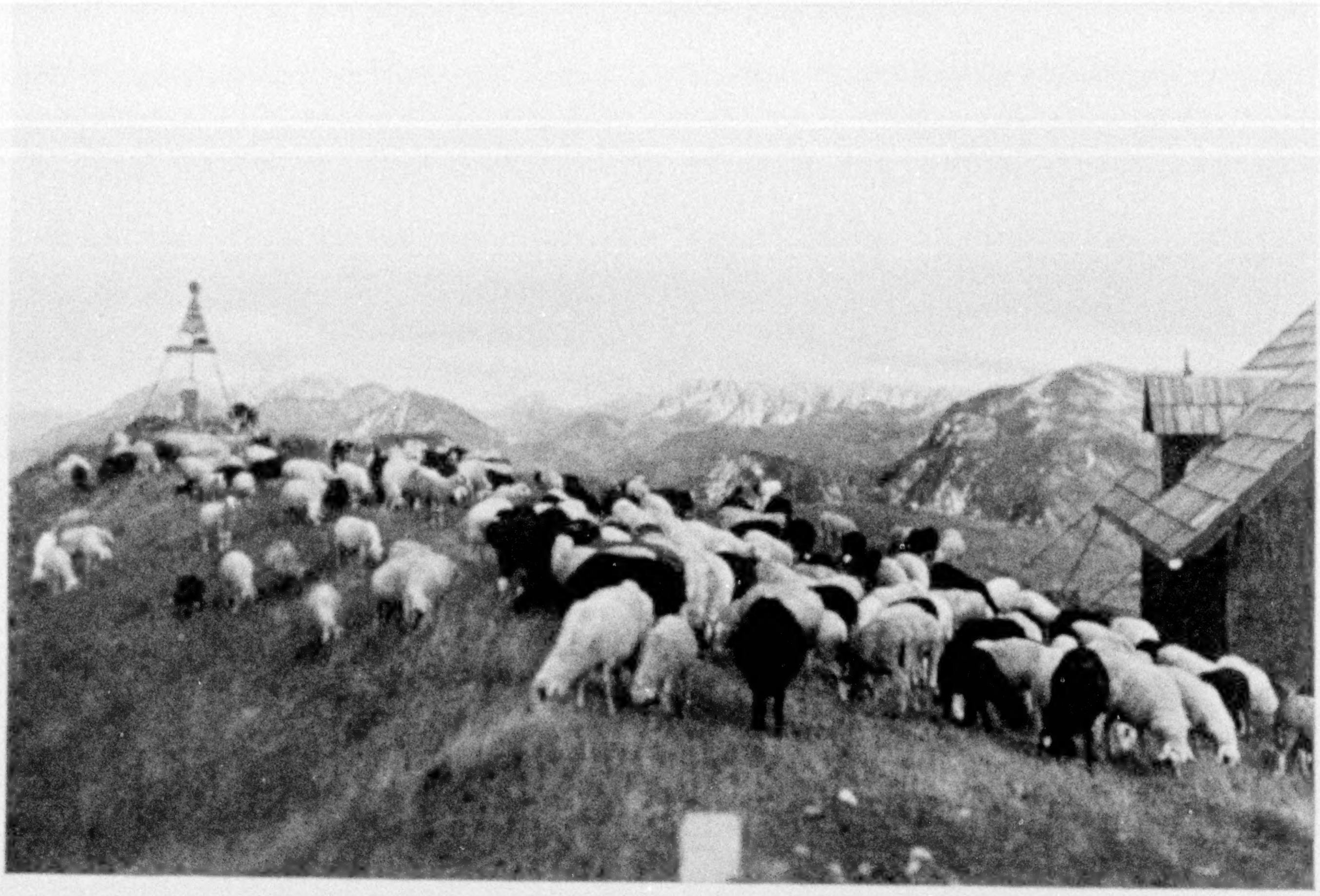
CROATIAN BOYS CAN SMILE DESPITE "SUNDAY CLOTHES"

Embroidered shirts and jackets, white stockings, and yellow slippers or decorated boots make their costumes strikingly colorful, but the sheepskin caps, worn the year round, seem a bit warm for summer.



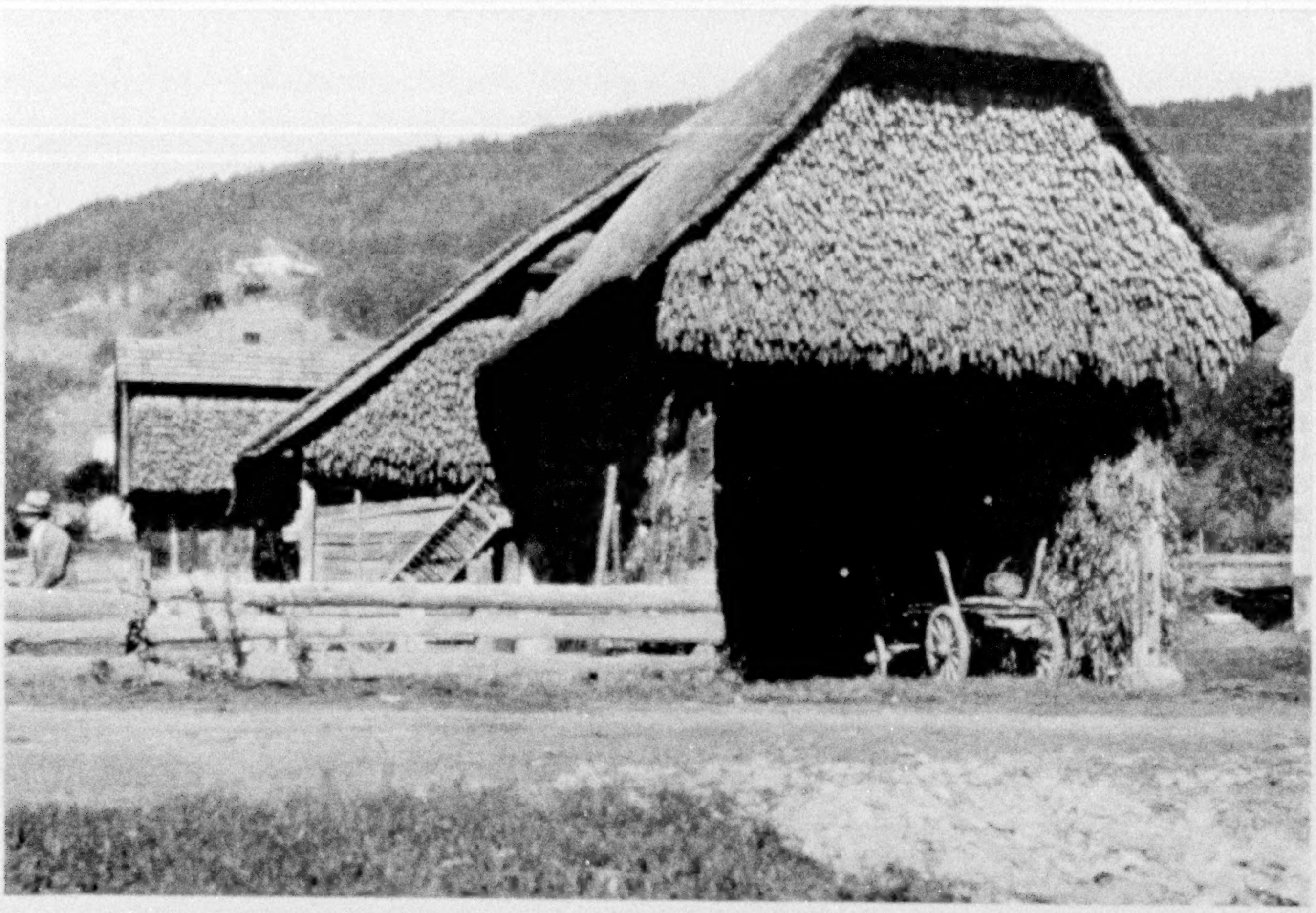
Photograph by Fr. Pavlin

SHEEP GRAZING IN THE JULIAN ALPS OF SLOVENIA

Photograph by Melville Chater

LIKE DIOGENES IN HIS TUB, THE SWABBER LIVES IN CASKS

His job during the grape-pressing season is to clean the containers in preparation for the new wine. He is crawling out of a hole in the head of a barrel which he has finished scrubbing.



SLOVENIAN FARMERS DRY MAIZE ON RACKS BUILT AGAINST THEIR BARNS

Photograph by Alice Schalek

LOVELY FALLS LINK A SCORE OF MOUNTAIN LAKES NEAR ZAGREB

Some of the finest natural scenery in Jugoslavia is found here, where the clear waters from the Plitvička chain of pools leap down from level to level in dashing cataracts (see page 296).

tioning passers-by until at last an old peasant indicated that he knew the way and would guide us. Bearing our impedimenta, joyously we followed him. Presently he pointed to some remains of ancient masonry and therewith began to pantomime face washing.

We investigated those venerable but quite waterless ruins. Had they contained as much as a stagnant puddle we might have been tempted, especially the fellow who brought bath salts along, to drown that miserable old man. And yet they *were* baths; any archeologist would have agreed with him. The only drawback was that they were Roman baths and hadn't been in working order for some two thousand years.

CROSS AND CRESCENT ABIDE TOGETHER PEACEABLY AT BIHAĆ

Next day we came to Bihać, where Moslem minarets and Christian spires rose side by side over the rushing river. Like many a Jugoslavian town of mixed religious elements, Bihać, with its well-cultivated gardens and neat homes, exemplifies how readily Christian-Moslem communities will, if left to themselves, flourish and fraternize.

This fraternalism was abundantly marked along our route from Bihać to the lakes.

We climbed through such beautiful woods of white birch and evergreens as commonly prelude Canadian lake regions. Then from a summit we beheld a chain of woodland-bordered, disklike expanses whose waters descended by cataracts from one lake into another (see page 295).

The Plitvička Lakes reveal Nature in a mood for producing lovely miniatures. Here she has created sixteen of them with, one might say, meticulous regard for just the right colors, backgrounds, and cliff contours; or, to change the simile, she fashioned a necklace of aquamarines, each one varying in shade from the other, then flung its outstretched links between the bases of green-bowered hills.

Some lakes were destined to bear the canoes and inherit the names of great explorers. Smaller ones have proved their appropriateness for summer colonies and motor-boat racing. The yet-smaller Plitvička Lakes remain, in their remote serenity, a natural sanctuary, where poets of some "lake school" might gather and where water nymphs—classic ones, not those of the one-piece-suit kind—might gambol under the moonlight.

I may add, lest water nymphs be considered out of fashion, that we encountered one. It was a few days' journey beyond the Plitvička chain. She was carved of wood, almost to human scale—twin tails and flowing ringlets complete—and she adorned the gable of a storage shed for logs that floated down the adjacent stream. She was a genuine undine that some log-jammer had set up in propitiation of local water sprites (see page 285).

It was somewhere between the lakes and Zagreb that we stopped to inspect one of a score of agricultural training schools that are dotted over Jugoslavia. Issuing from the classrooms, we traversed neatly planted truck plots, including a patch of big, luscious-looking watermelons. Laurence lingered behind on that melon patch in such a suspicious way that we hailed him to come on.

Catching up with us, he said with a fine implication of emphasis, "I was goin' to *buy* one."

"You can't," we told him. "They're Government watermelons."

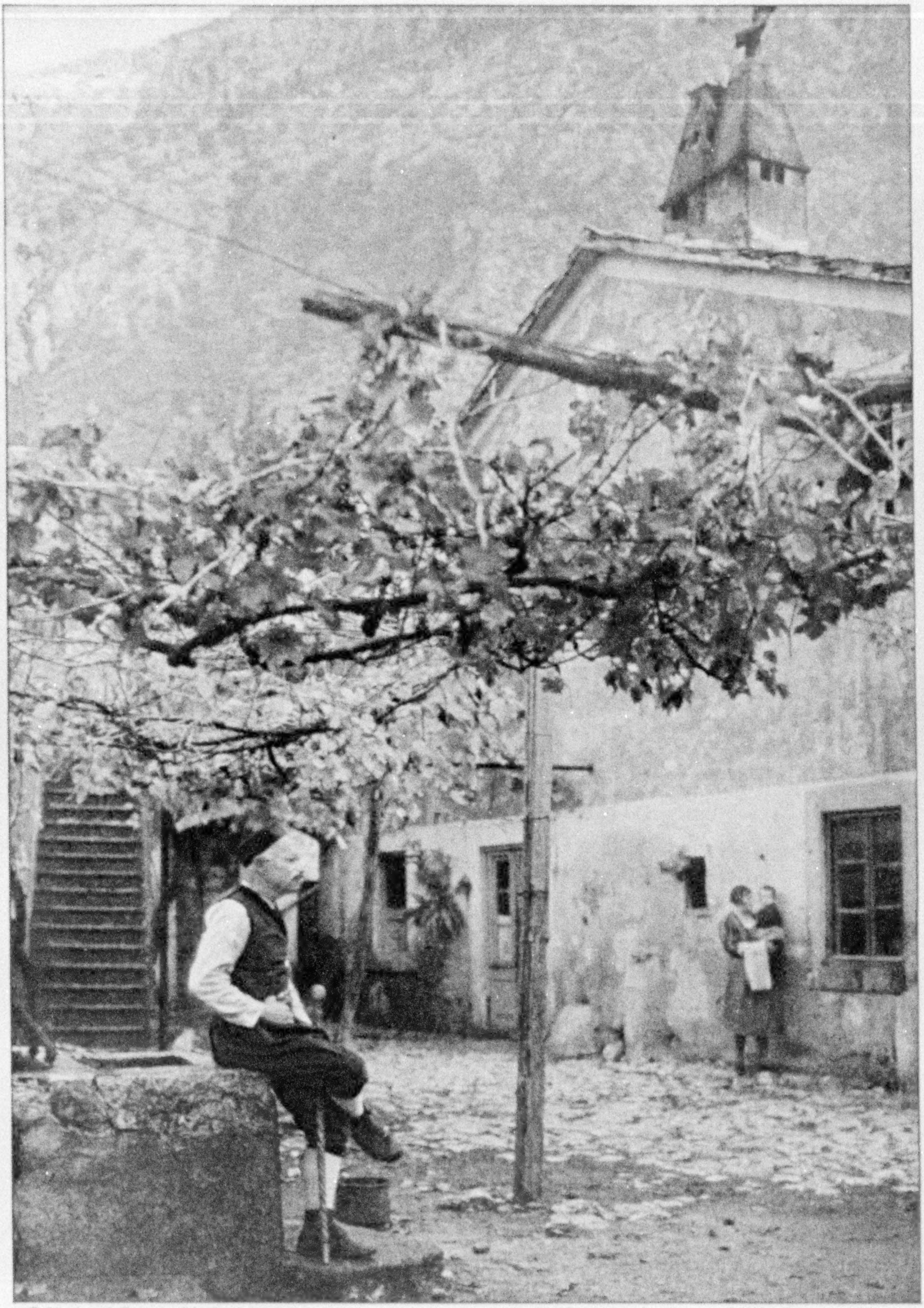
And as we drove off we heard him mumbling to himself, "Never did heah of Gov'ment watermelons! Gimme a free man's country!"

A fleeting glimpse of Karlovac and its factories revealed that we had left primitive Bosnia and were crossing industrial Croatia—a province which contains some of the kingdom's busiest manufacturing centers.

Jugoslavia's key industries, based on timber, chemicals, iron, and sugar beet, are retarded by her lack of fuel. Costly importations of coal must supplement her inadequate output of 4,000,000 tons a year. The Arabian wizard's cry of "New lamps for old!" proved no less magical a phrase than "White coal for black!" will prove, once Jugoslavia harnesses her fast-flowing rivers (see, also, text, page 264).

INDUSTRY AND PROGRESS MARCH HAND IN HAND

The output of the above-named industries, together with live stock, cereals, bauxite, and cement, form Jugoslavia's exports. Her imports consist chiefly of



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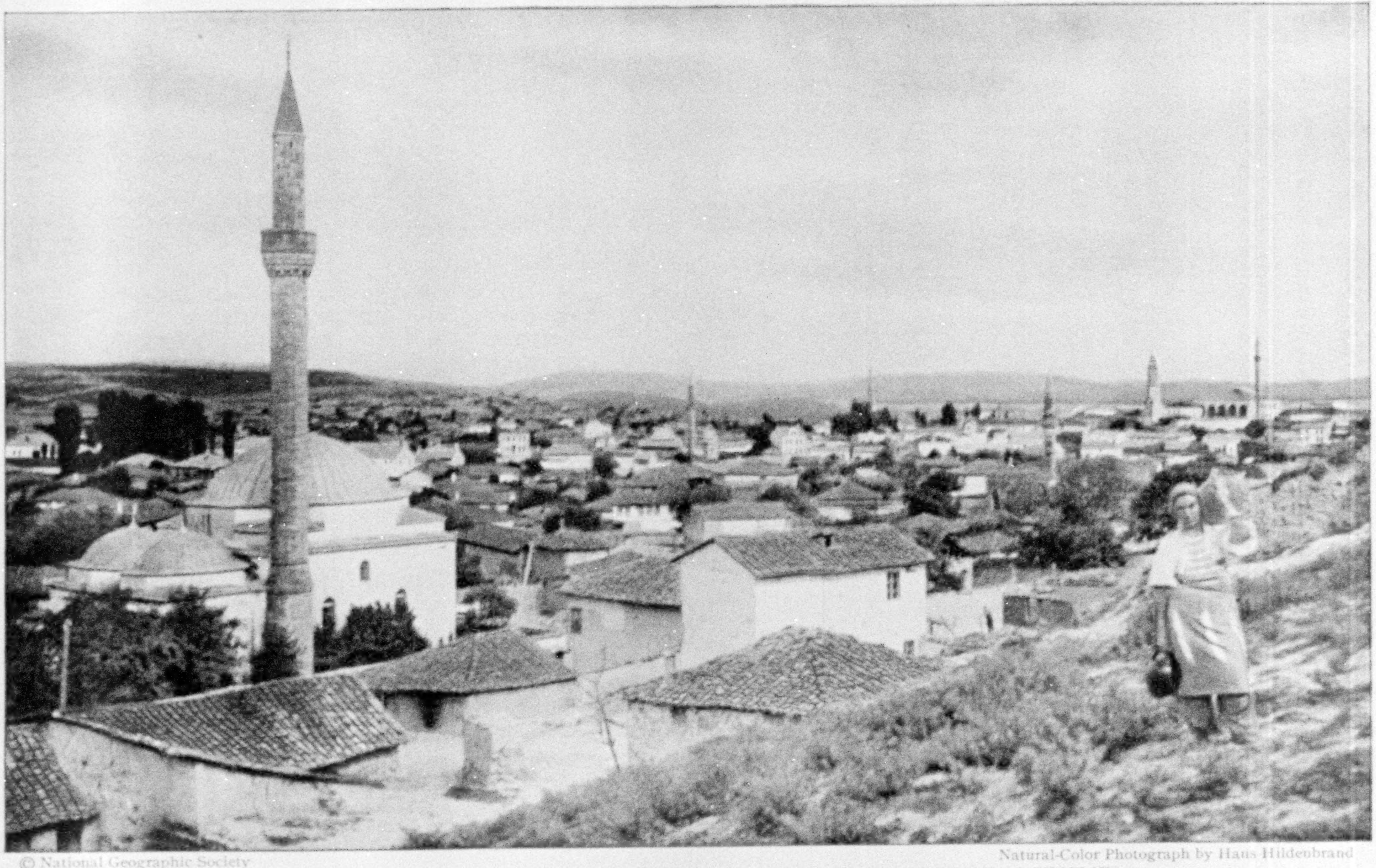
A PATRIARCH OF KOTOR (CATTARO) ENJOYS THE PEACE OF HIS ARBOR

The port of entry to the Montenegrin section of Jugoslavia has unusual possibilities as a commercial or naval base if railway connection is established with the cities of the interior. Its sturdy inhabitants are passionately devoted to their rooftrees.



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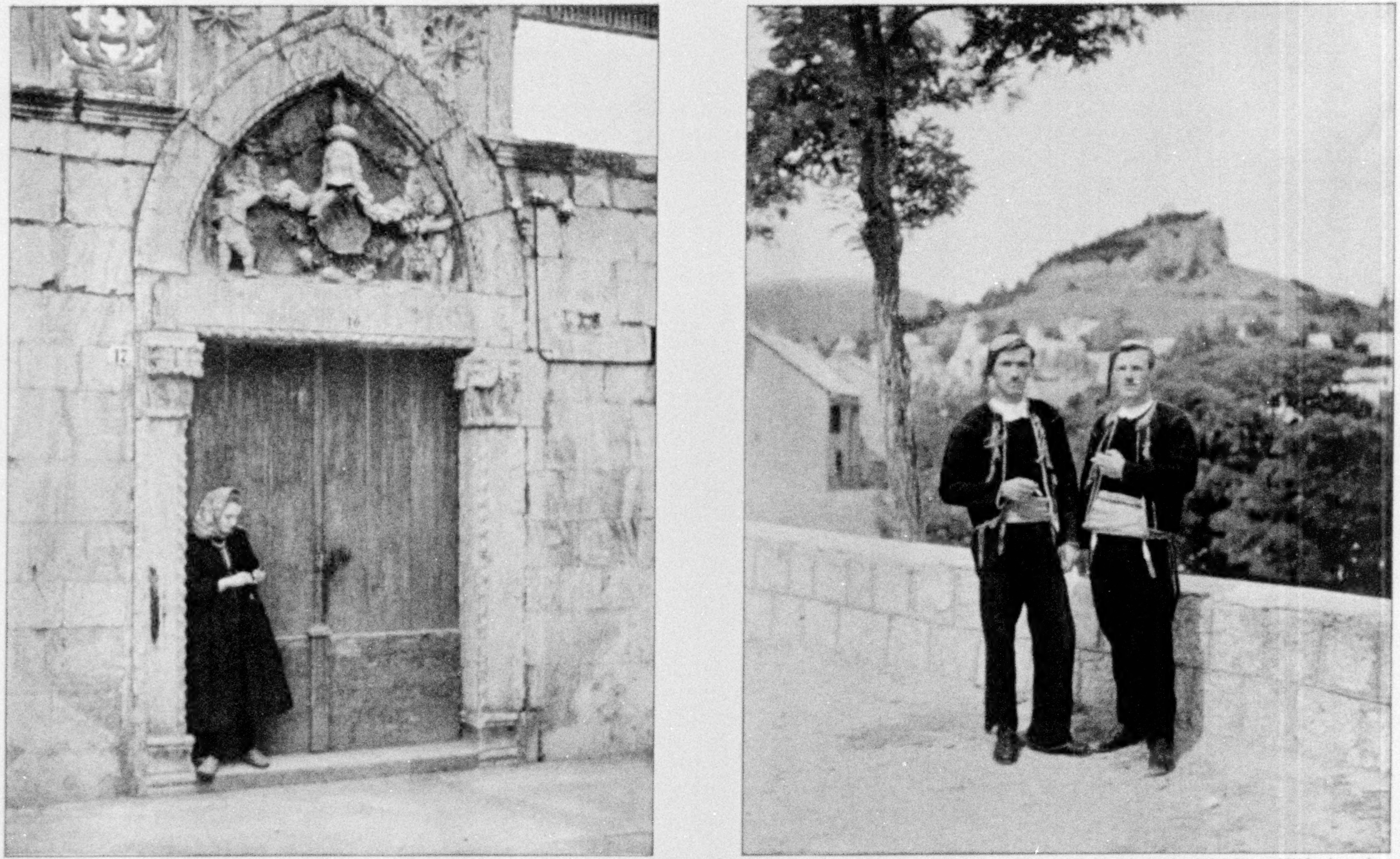
Natural-Color Photograph by Hans Hildenbrand

NUMEROUS SLENDER MINARETS ATTEST A LARGE MOHAMMEDAN POPULATION AT SKOPLJE

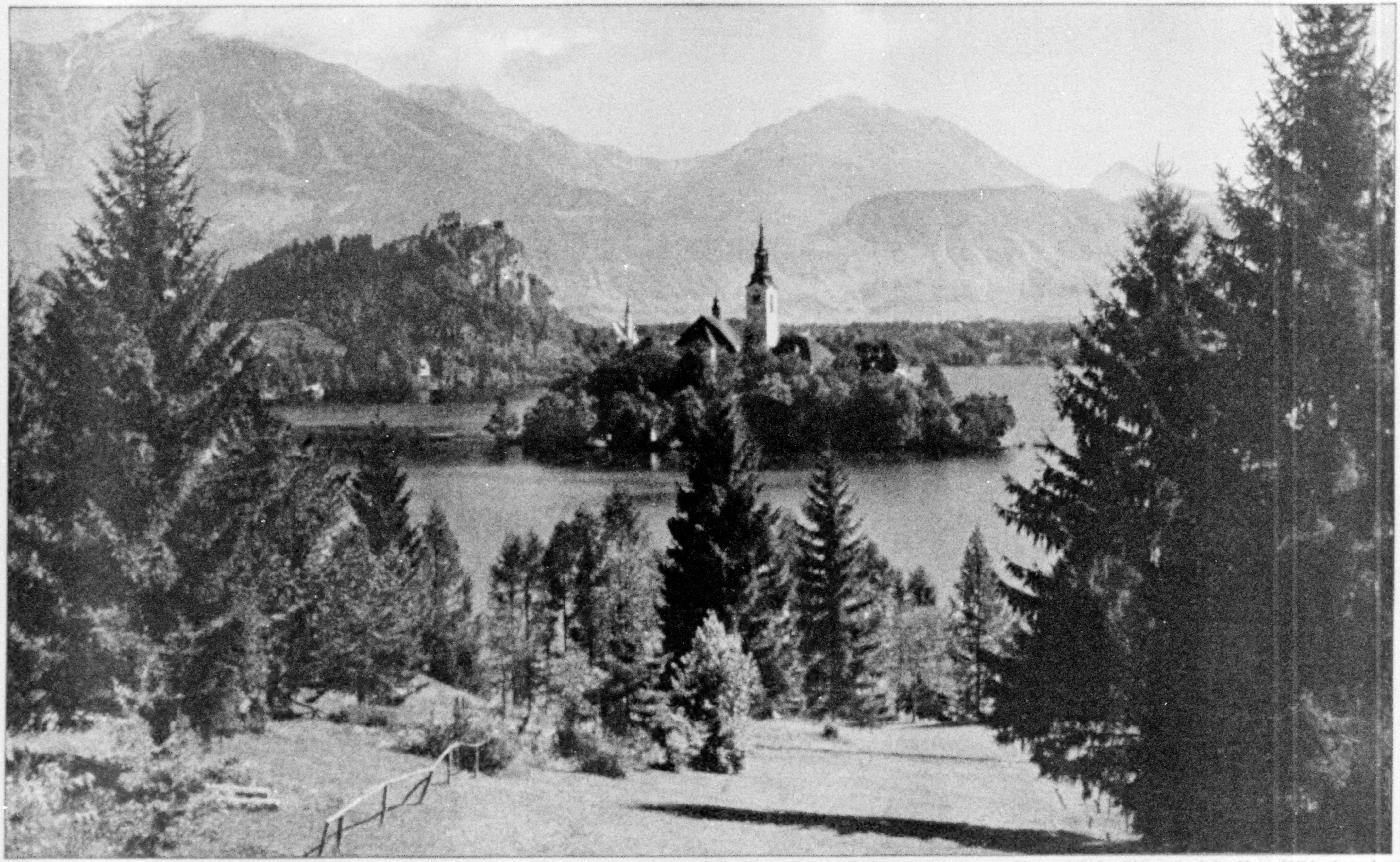
Despite its importance as the commercial and distributing center of south Serbia, this city is not as modern as some of the other large communities in Jugoslavia. However, it is alive to its needs and has projected, among other municipal improvements, an up-to-date electric power plant. The 50,000 inhabitants, many of whom are Moslems, get their water supply entirely from springs and wells (see also Color Plate IV).



Natural-Color Photograph by Wilhelm Tobien © National Geographic Society Natural-Color Photograph by Hans Hildenbrand

ROMANCE AND HISTORY CLING TO THE FAIR DALMATIAN COAST

Successively under the rule of Venice, France and Austria in recent centuries, the western shores of the Adriatic, a region where East meets West, are now among the fairest possessions of the new kingdom of Jugoslavia. The old doorway at Rab (left) once gave entrance to a Venetian palace. The two young men are from the vicinity of Split (Spalato), a coast town between Zara and Dubrovnik.



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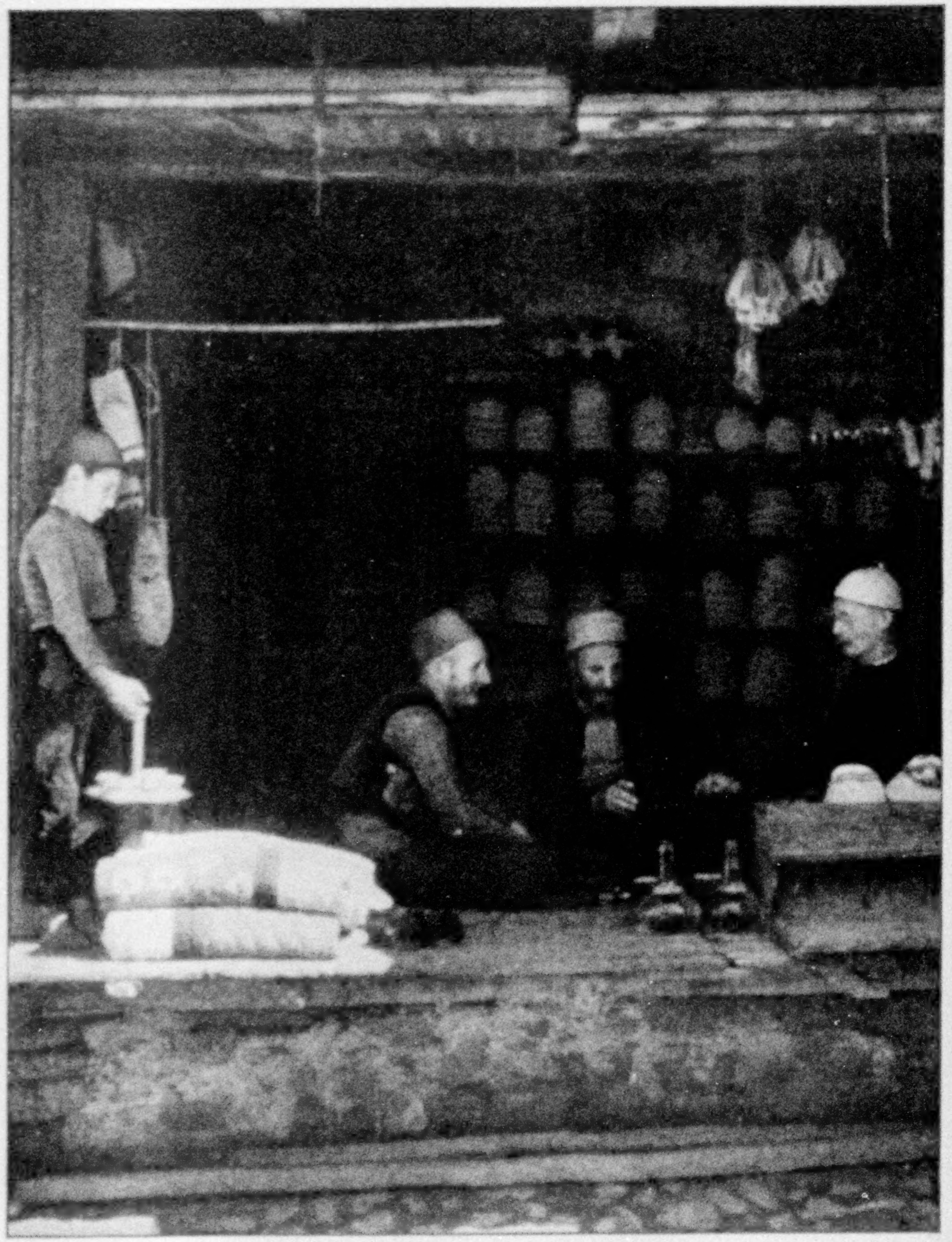
Natural-Color Photograph by Hans Hildenbrand

THE ISLE IN ALP-GIRT LAKE BLED MIGHT WELL BE THE SCENE OF A FAIRY TALE

Time has wrought little change in the valleys, mountains and lake shores of Kraniska (Carniola), and although it is a favorite summering place, it has not lost its idyllic charm.



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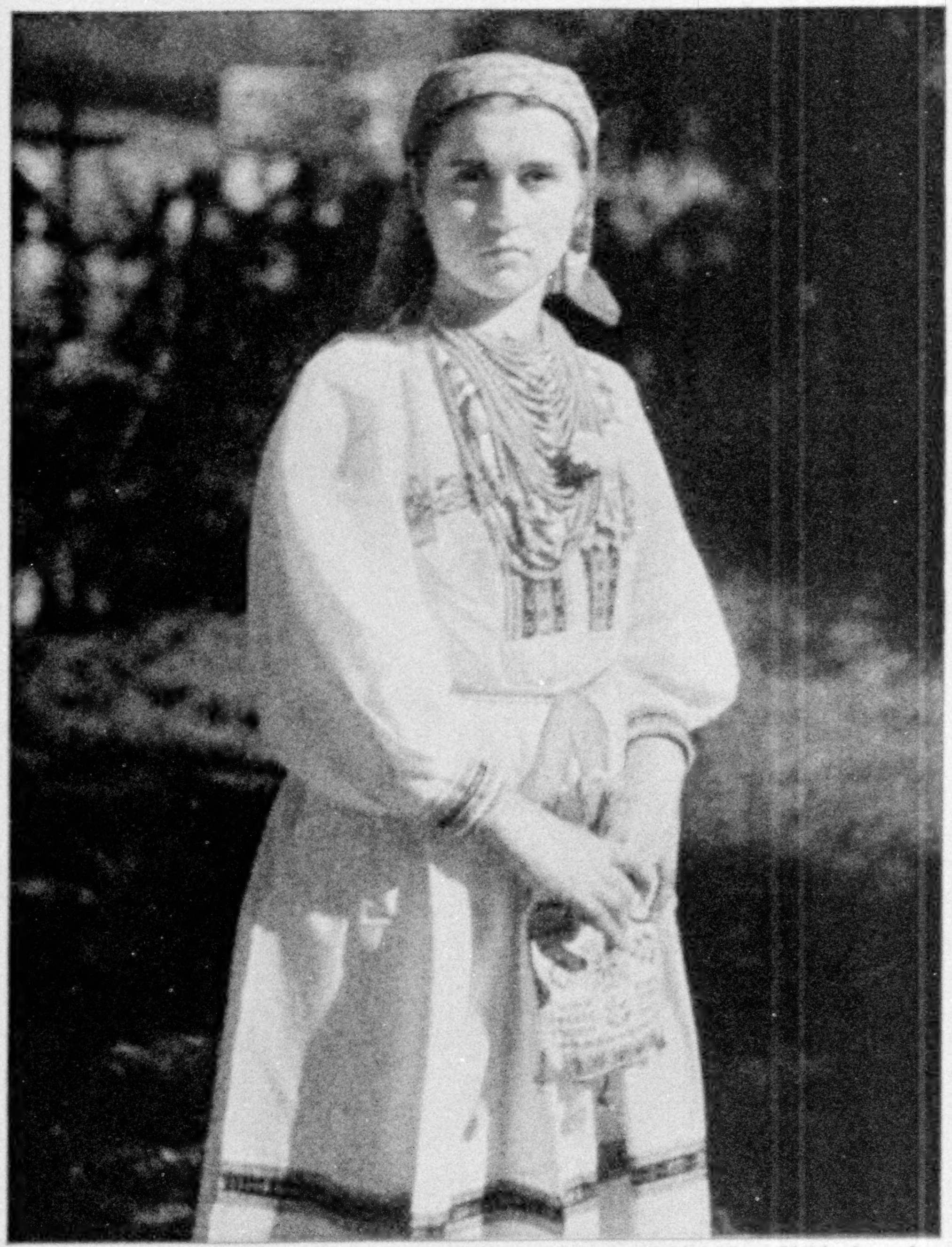
BUSINESS DOESN'T TAKE ITSELF TOO SERIOUSLY HERE

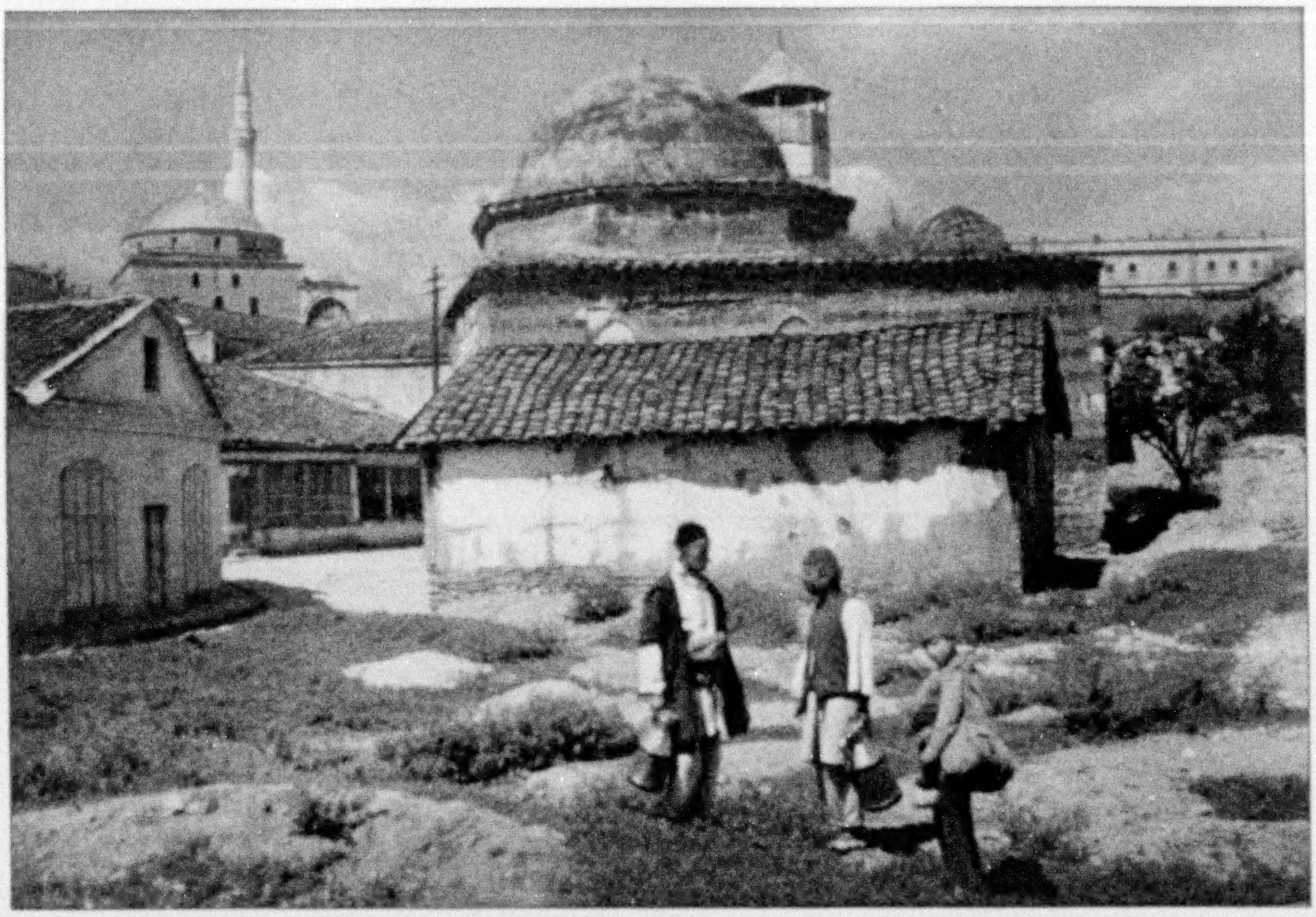
During the drowsy afternoon hours commercial activities lull and boys from near-by cafés carry around trays laden with small cups of coffee to serve their regular patrons. Fez merchants of Priština.



Natural-Color Photographs by Hans Hildenbrand

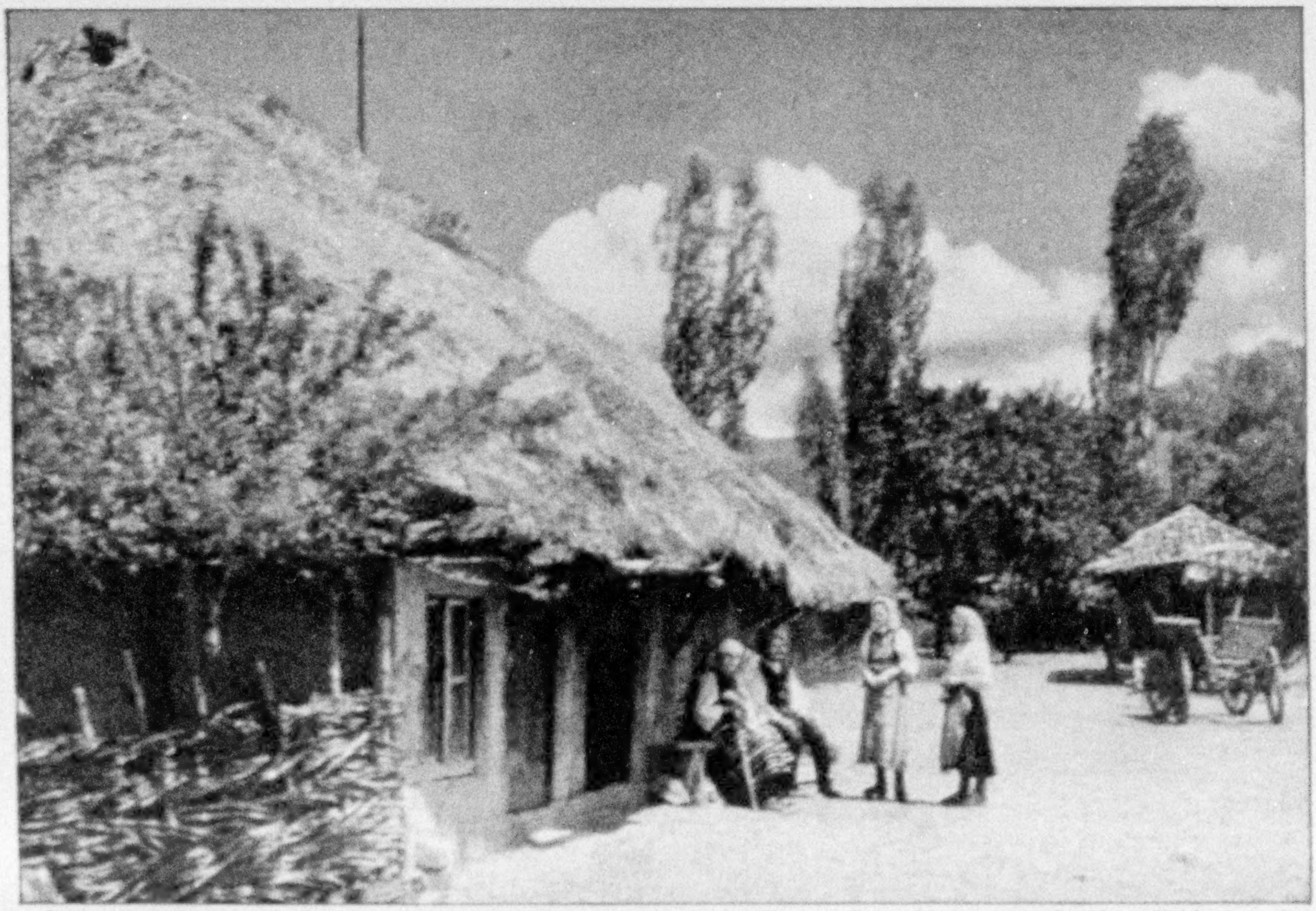
SLOVENE WOMEN CREATE THEIR OWN ADORNMENT

Exquisite hand embroidery embellishes the apparel of young and old, and the fame of their work has spread until it is now eagerly sought after in the fashion centers of the world.



TREASURES OF ART LIE HIDDEN IN SKOPLJE'S DINGY TURKISH QUARTER

Priceless rugs, tapestries and weapons adorn some of the old houses of once powerful Turkish citizens.



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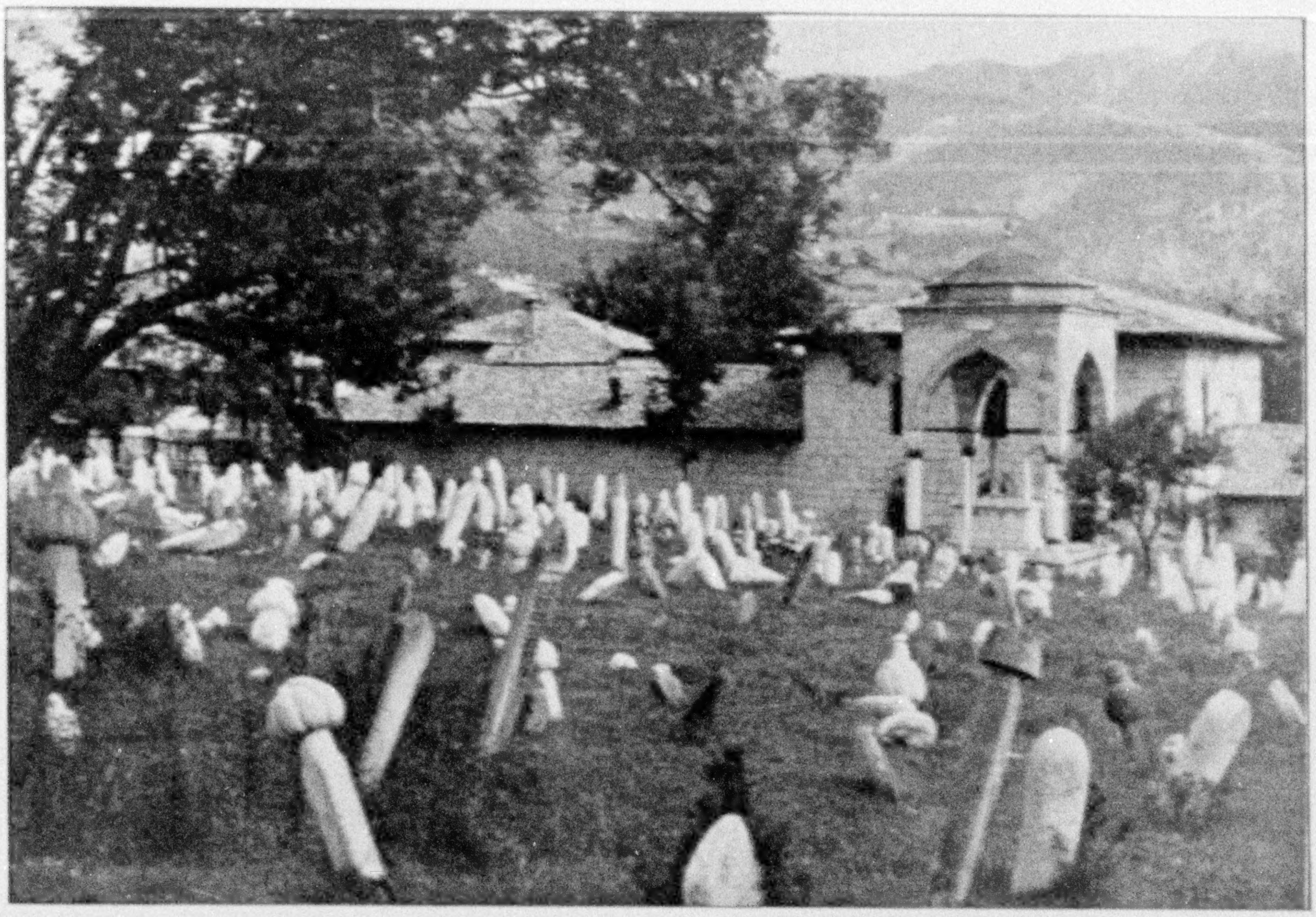
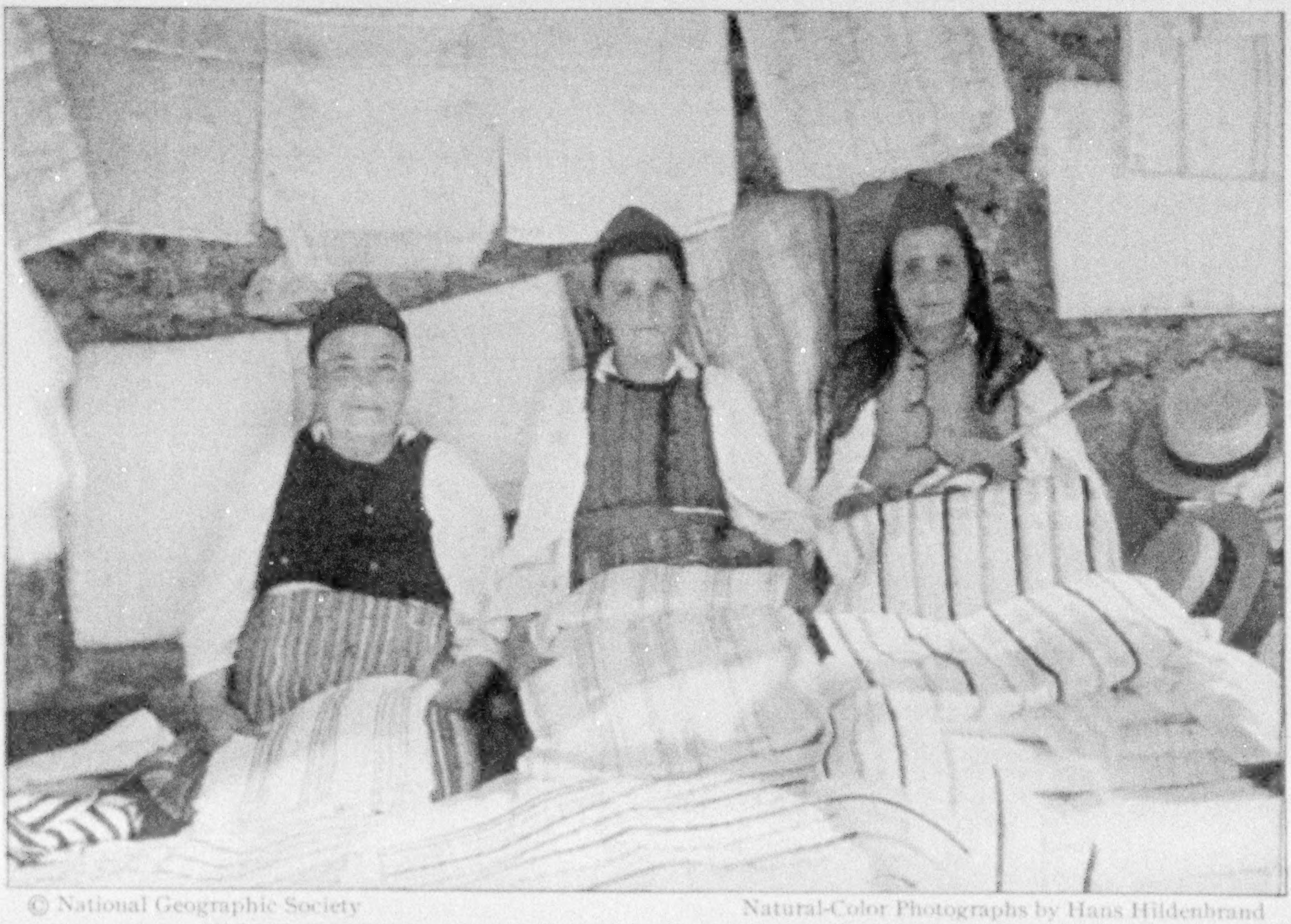
SACRED MEMORIES HALLOW THE PLAIN OF KOSOVO

This old style peasant dwelling is located on the field where, in 1389, at the Battle of Kosovo, Turks led by Sultan Murad I crushingly defeated the Serbs under Tsar Lazar. Both leaders were killed, the Sultan by a Serbian patriot's dagger, and the Tsar, a prisoner, by the executioner's sword.



MOSLEM GRAVEYARDS STAND IN THE PATH OF PROGRESS

To a Mohammedan, the last resting place of one of the faithful is a sacred spot which must not be disturbed.



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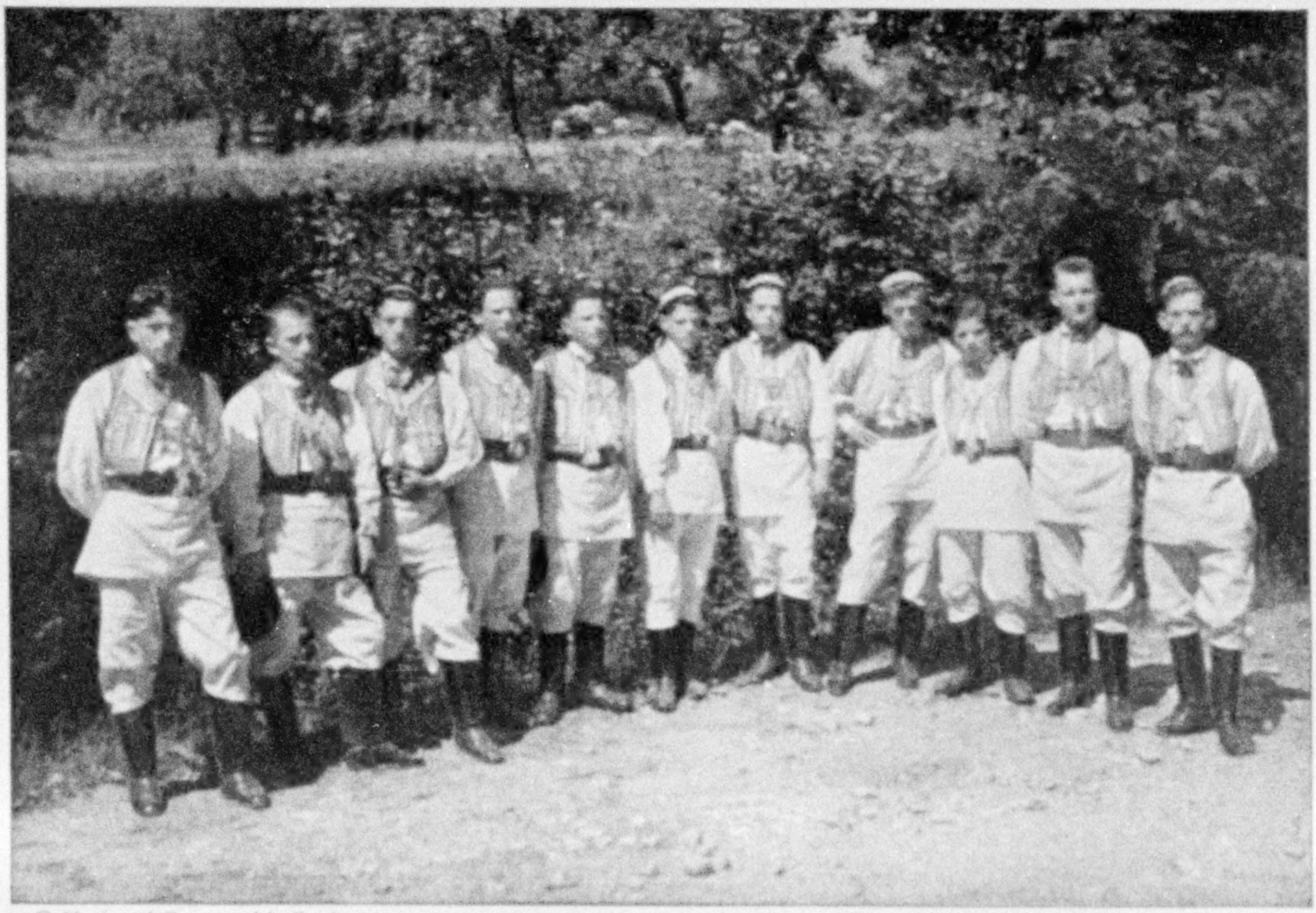
JUGOSLAV MATRONS TAKE PRIDE IN THEIR HANDWOVEN FABRICS

Linens, woolens, and cotton cloth are made in the homes of peasant women. Housekeeping here is not numbered among the lost arts and the "homemade" label is found on so many articles of family use that it actually serves as a deterrent to the industrial development of the Nation.

SCHOOL IS NOT A NEW EXPERIENCE FOR CHILDREN OF CROATIA

Before the formation of the present Jugoslav State the Croats were under the rule of Austria and were allowed some educational privileges. These peasant children are from the vicinity of Zagreb (Agram).



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Natural-Color Photographs by Hans Hildenbrand

ON YOUTHS LIKE THESE JUGOSLAVIA RELIES FOR PROGRESS

The older generation is loath to change its ways, but young men, trained in scientific methods, will develop the best their land affords. Croatian peasant boys.

raw materials for her textile and other industries, to which purchases the United States contributes 4 per cent.

Zagreb, Croatia's capital, ranks among the foremost of Jugoslavia's industrial centers. The spirit of progressiveness speaks in its fine public buildings, its handsome squares, its humming activity, its frank determination to keep Croatia prominent on the commercial and political map.

The last-named characteristic runs true to form with Zagreb's history. Its civic annals began in the thirteenth century, when it was created "a free town of the king" in acknowledgment of its defense against the Tatars. Two centuries later the Turks advanced against Zagreb, but with no better luck. In the nineteenth century it centered Croatia's movement directed against the Hapsburgs' attempted Teutonization of the country. And so it is not without significance that there stands in Zagreb the statue of that Slavonian priest who became, as Bishop Strossmayer, the father of the Jugoslav national movement.

One might multiply proofs that that movement has amply justified itself. Yet Jugoslavia still has her problems, extraterritorial as well as internal. Into her melting pot have gone three peoples, Slavic in tongue yet differing in culture—differences which still express themselves in the form of sectionalism. But, with Jugoslavia's already substantial progress in evidence, few can doubt that she will achieve unification.

Zagreb consists of a once-fortified hill town and, beneath it, a modern complex of commerce. The turmoil dies away as you ascend hillward over a winding street that enters as curious a portal as ever divided a city's bustling present from its mellow past. It is the vaulted shell of what was anciently part of a castle and is now a street shrine. Through its dimness glows a starlike galaxy of altar candles, revealing icons and bowed worshipers, as among a press of footfarers you pass in at its one archway, then regain daylight through its other.

Beyond, all is muted peacefulness. There is not a street car, scarcely a shop front, to mar the etchinglike scene of St. Mark's Square, with its Gothic church, palaces, and Town Hall—a scene which for centuries has witnessed the determining of Croatia's destinies. Then, issuing from the square, you find yourself on a tree-vistaed promenade, from which vantage point among the upper town's past you survey the panorama of the lower town's busy present.

Descend into that present and you can scarcely miss finding yourself among one of the most picturesque market scenes in Europe. It is that of the great Jelačić Square, ranged from end to end with planks on trestles, with every kind of farm product heaping the planks, with festally costumed Croatian women at each stall, and with a milling mass of basket-carrying housewives—a cash-and-carry spectacle involving a thousand or so participants (see pages 291, 309).

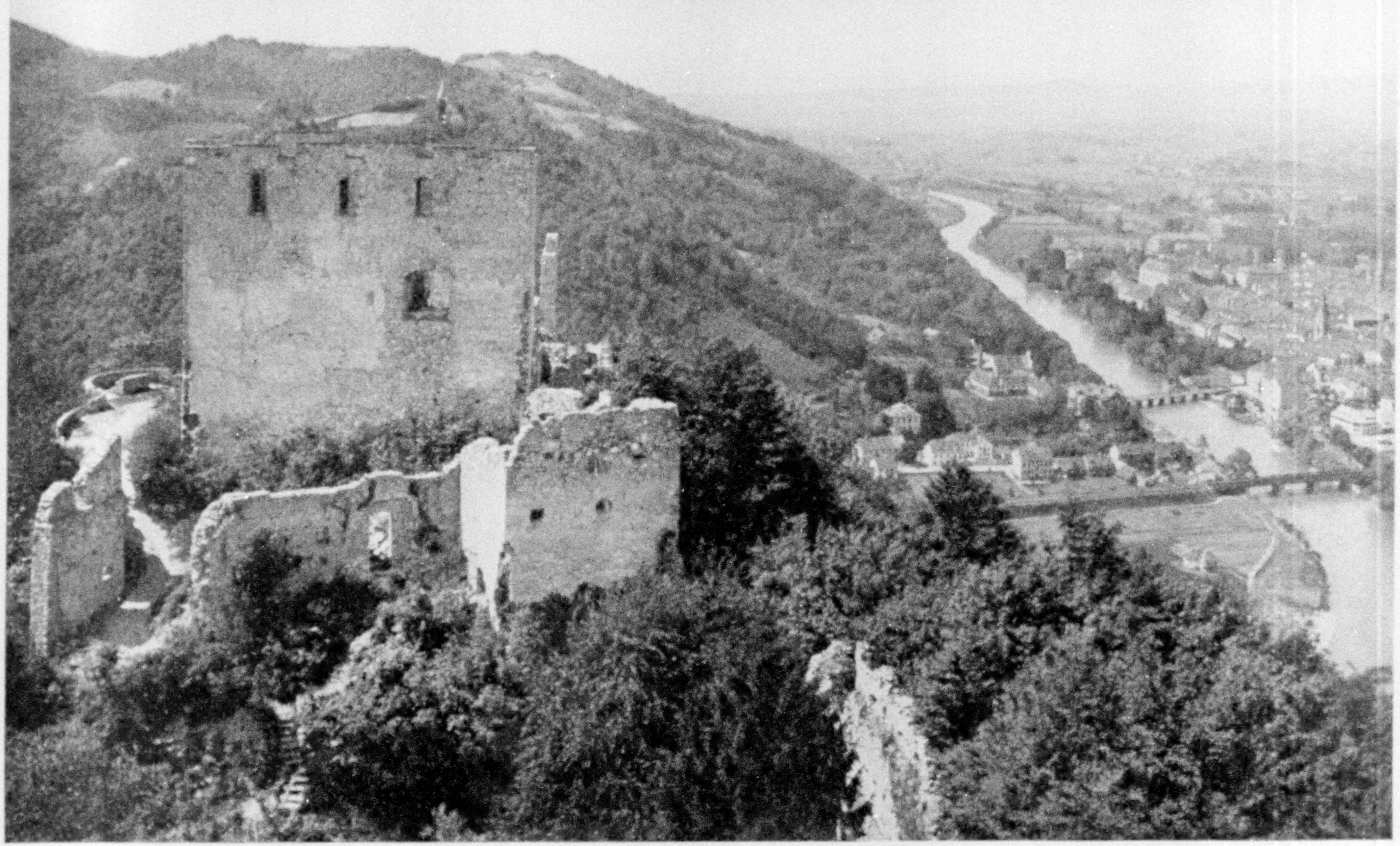
ZAGREB'S MARKET A RESPLENDENT SIGHT

A market is just a market, but Zagreb's more nearly resembles a civic fête, performed in fancy costume and supervised by a skilled stage director. Each of the hundreds of Croatian stall women is adorned in gorgeous, hand-woven raiment, including short skirts and white stockings on plump legs, whose calves are encircled by coquettish, cherry-colored bows.

Why these early-rising, produce-toting peasants from outlying farms thus begay themselves daily as for a festival remains for sober-clothed Westerners a mystery, for this gala sight is staged every day of the year. At dawn municipal employees set up the stalls. For six hours the spectacle goes on. Then at noon, as if a wand had been waved, everything—stalls, produce, costumed peasants—melts away. The square changes like a stage denuded of scenery and the rapt onlooker wakes as from illusionment.

THROUGH "BEER IN THE BUD" COUNTRY

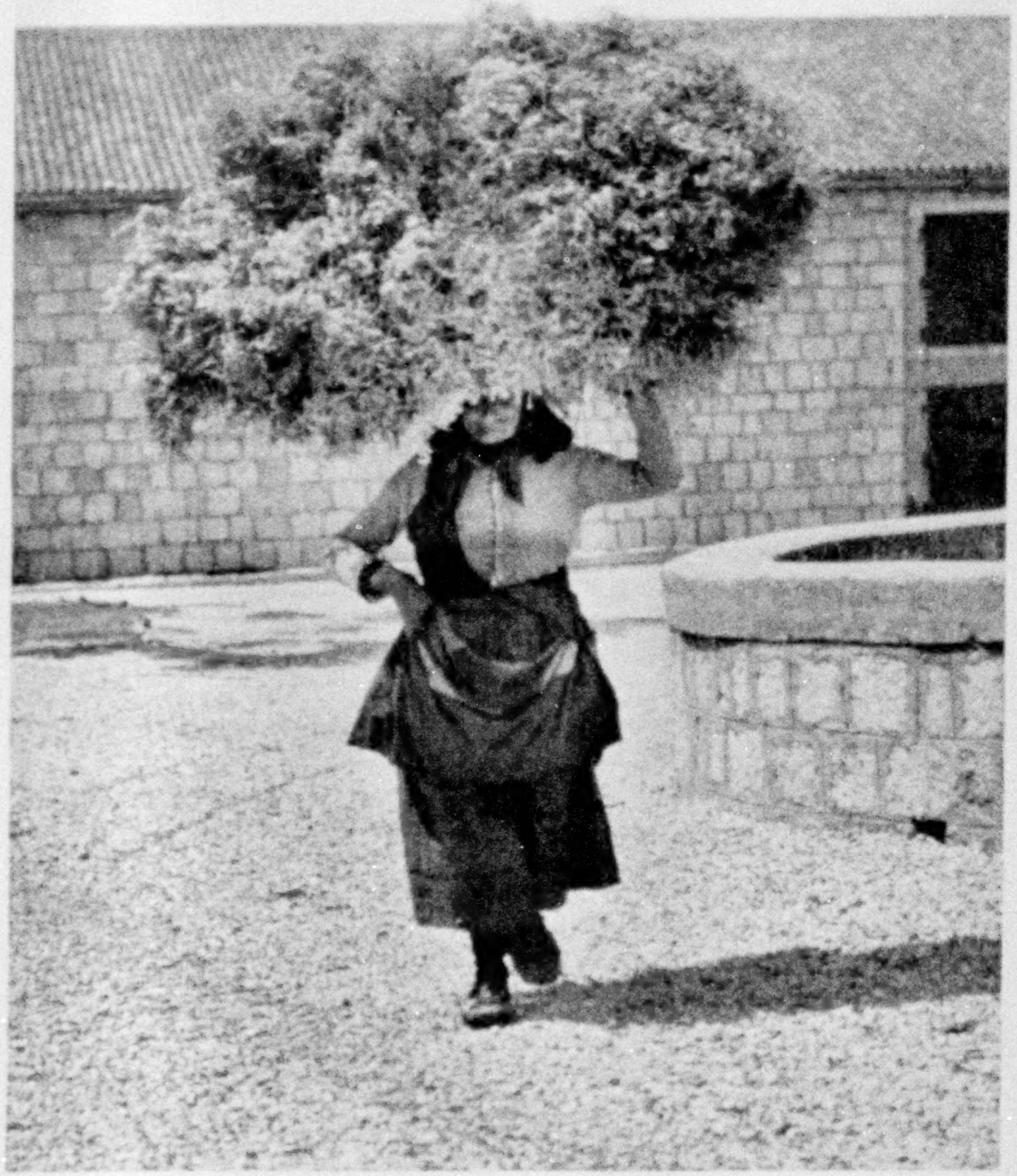
From Zagreb we circled through Slovenia, that lovely, sub-Alpine province of a remarkably diversified kingdom. Now we penetrated a region of trellises laden with luxuriant vines, whose aroma revealed that we were in a hop country—"beer in the bud." Now hops gave way to orchards and vineyards, and these to newly furrowed fields, strikingly black among Slovenia's bright-green pastures; and always the air grew keener, and the multitudinous streams sang more shrilly



Photograph by Atelje "Pelikan"

ILLYRIAN TRIBES FOUNDED CELJE 200 YEARS BEFORE THE CHRISTIAN ERA

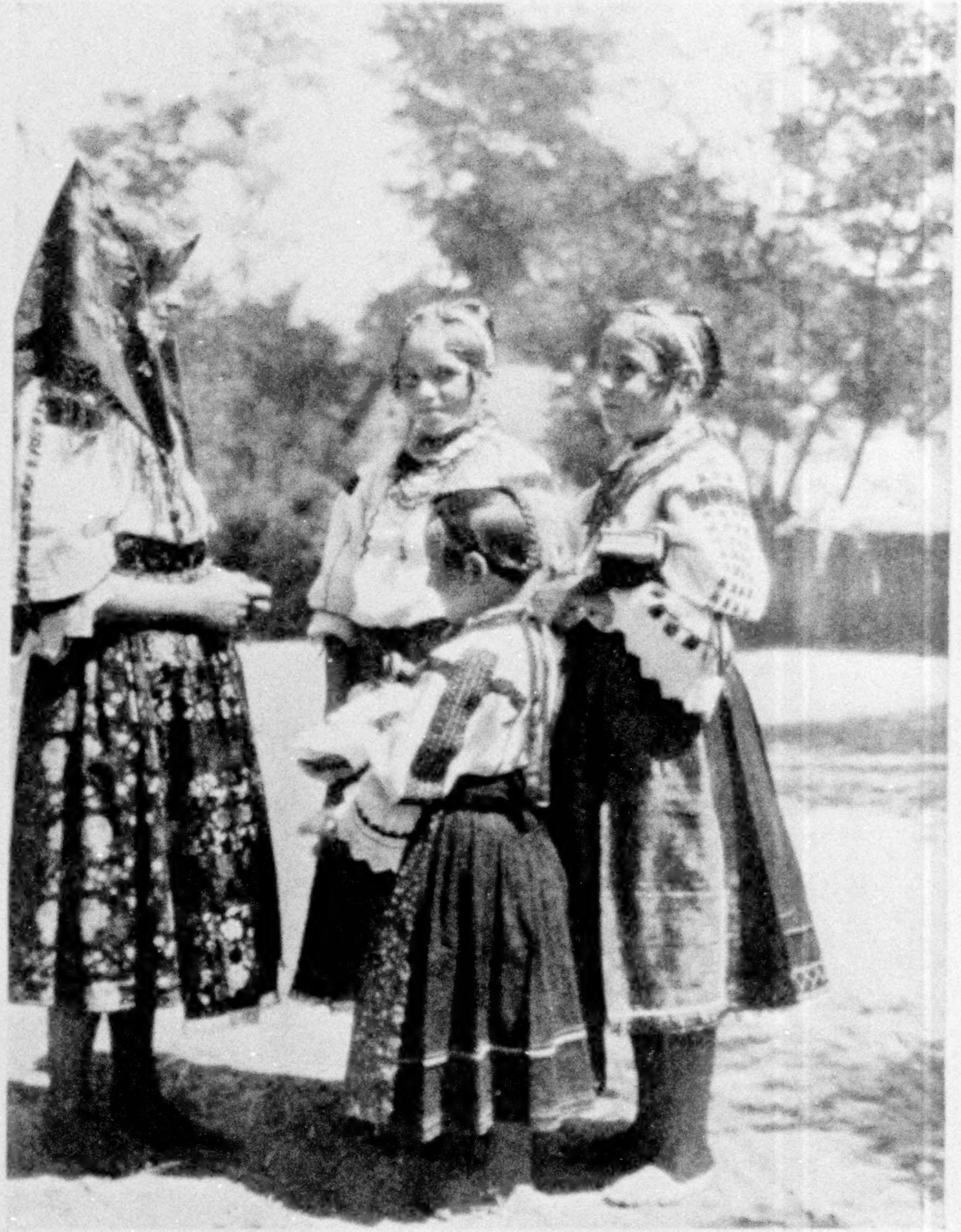
This ancient city on the Savina, a tributary of the Sava, in Slovenia, fell into the hands of conquering Celts in the early years of its existence. Later it became a Roman fortress against the barbarians. For 13 centuries it has been in the possession of Slavic people. During the Crusades it served as one of the most important stations between western Europe and the Holy Land, but sank into comparative oblivion after interest in those expeditions waned. Since the World War it has been a part of Jugoslavia and is showing signs of revived life. The ruin in the foreground is that of the feudal castle of the counts who ruled the country in the Middle Ages.



Photograph by Melville Chater

FURZE SERVES AS KINDLING IN CROATIAN COAST TOWNS

Wood is at a premium here and in Dalmatia, for the country was stripped of forests for lumber to build Venetian galleys centuries ago.



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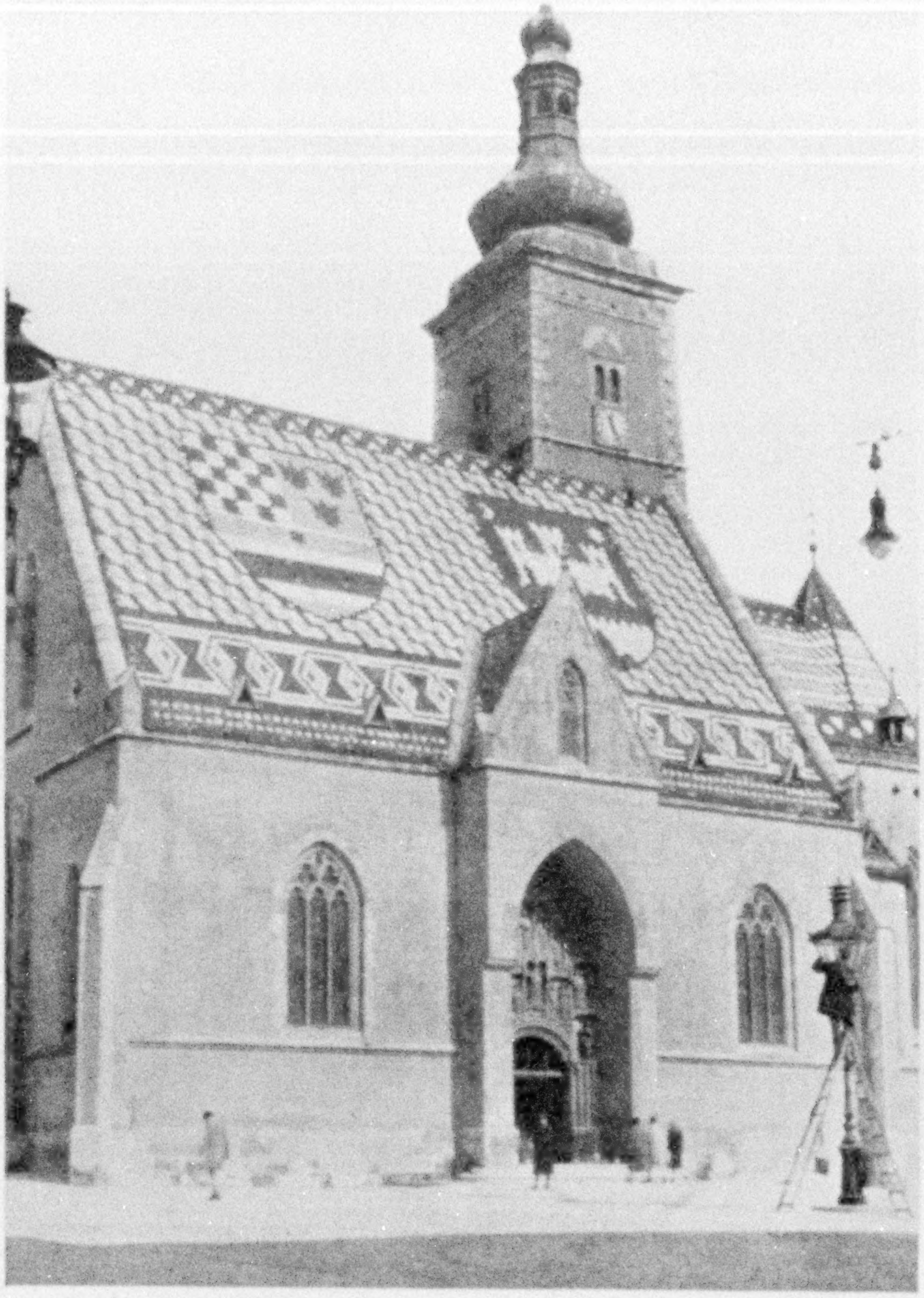
SAVA RIVER SLAV GIRLS DELIGHT IN FINERY

Necklaces of Hungarian coins and embroidery in elaborate designs are distinctive touches in the costumes worn by this group.



Photograph by Melville Chater

ARMS OF THE CITY (RIGHT) AND OF CROATIA (LEFT) ADORN THE ROOF OF ZAGREB'S ST. MARK'S

King Bela IV of Hungary rebuilt this Gothic church after the invasion of the Tatars in the 13th century. It stands in St. Mark's Square, which has viewed the pageant of Croatian history.

as pastures yielded to wild ravines and snow peaks rose against the blue.

"GOV'MENT GRAPES, TOO!"

"Have some American grapes!" called a peasant, as we halted once in Slovenia's lowlands. And, "Sure," we laughed back. "Make it Concords or Delawares!" But the laugh was against us when he arrived with some luscious clusters of those very varieties. In fact, as a result of war-time phylloxera, they were grown on Government-imported vine stock from the United States.

Three-quarters of Jugoslavia's vine areas have been renewed from the same overseas source, under Government regulations that stipulate for each Jugoslavian vineyard the reservation of one hectare of American plants for grafting purposes.

So much the farmer explained. And Laurence, who had overheard somewhat of it, muttered to himself, "Gov'ment *grapes*, too! Well, I'm switched!"

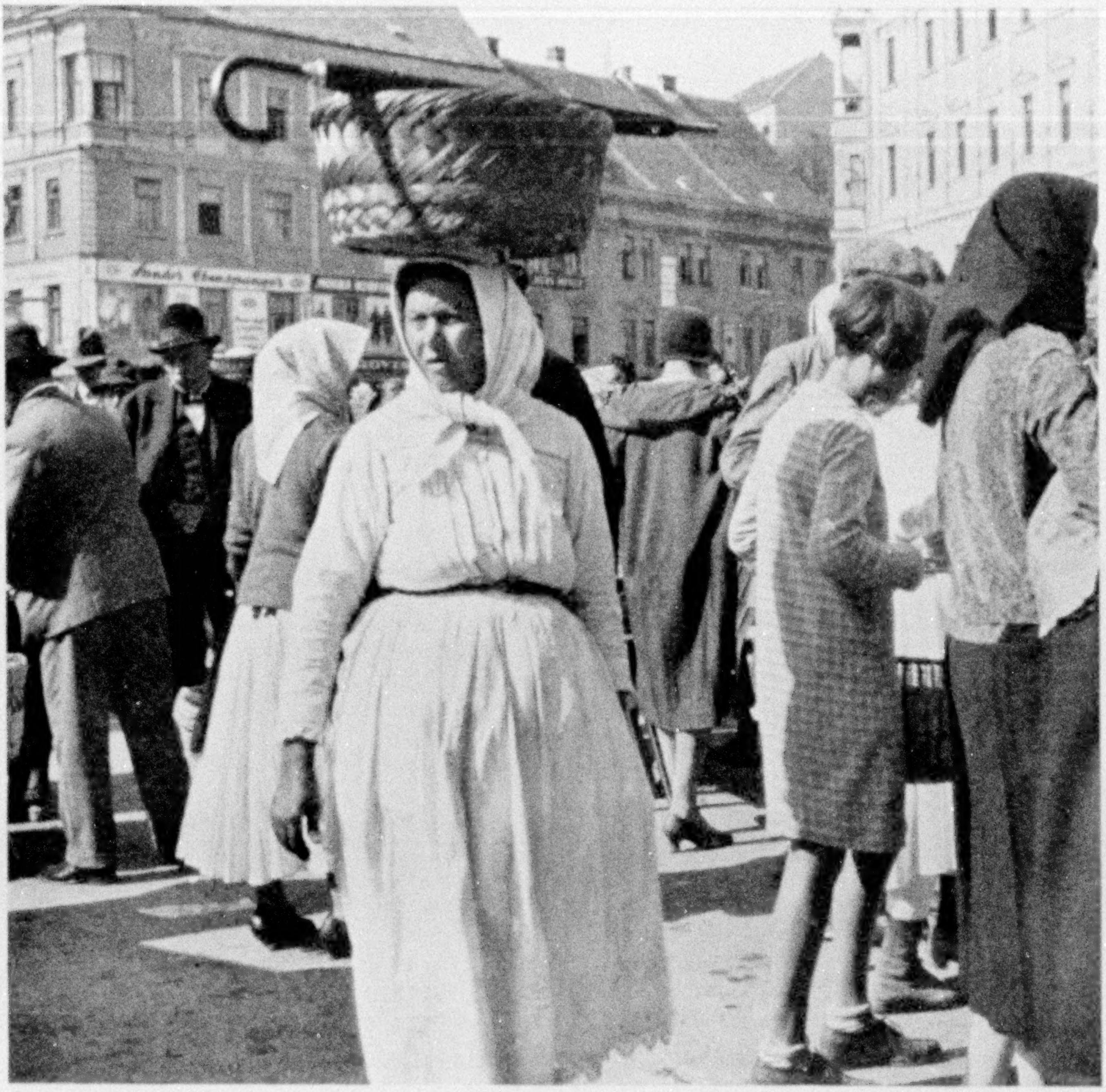
We neared Slovenia's westernmost limit, where, tucked away between the Julian and Karawanken ranges, lies that little sub-Alpine idyll, Lake Bled. With its island-set pilgrimage church and its overlooming castle, it might be some scene on a medieval tapestry (see Color Plate XII).

At the pleasant Styrian town of Maribor we encountered a tourist agent who told us that we really must visit near-by Rogaška Slatina. He said there were baths there.

"Roman baths?" we chorused.

"Roman baths of course," he assured us, mistaking our apprehension for enthusiasm. "Very famous. Everybody visits them." And, recollecting Banjaluka (see text, page 291), we smiled wanly. No more archeological remains for us.

Next day Laurence misread his road map, and that afternoon we turned up by accident at a delightful spalike resort, cupped among green hills. There were garden-bordered promenades and Greek pavilions, and a band playing, and people drinking the waters. A perusal of our pre-war map revealed that we were at Rohitsch-Sauerbrunn, with hotels, hydrotherapy, and baths—the actual, not the archeological, thing—at our disposal.



Photograph by Melville Chater

FOLK COSTUMES MINGLE WITH MODERN DRESS IN ZAGREB MARKETS (SEE PAGE 305)

We remained there for two days, rejoicing in a perfect bathing orgy; and it wasn't until we bought some picture postcards captioned with "Greetings from Rogaška Slatina!" that we discovered we had been staying in the very place we had sought to avoid. In fact, that designation is the Slav replacement name for Rohitsch-Sauerbrunn. As for its "Roman baths," our informant had evidently meant the modern, calorific thing and not ancient *thermæ*.

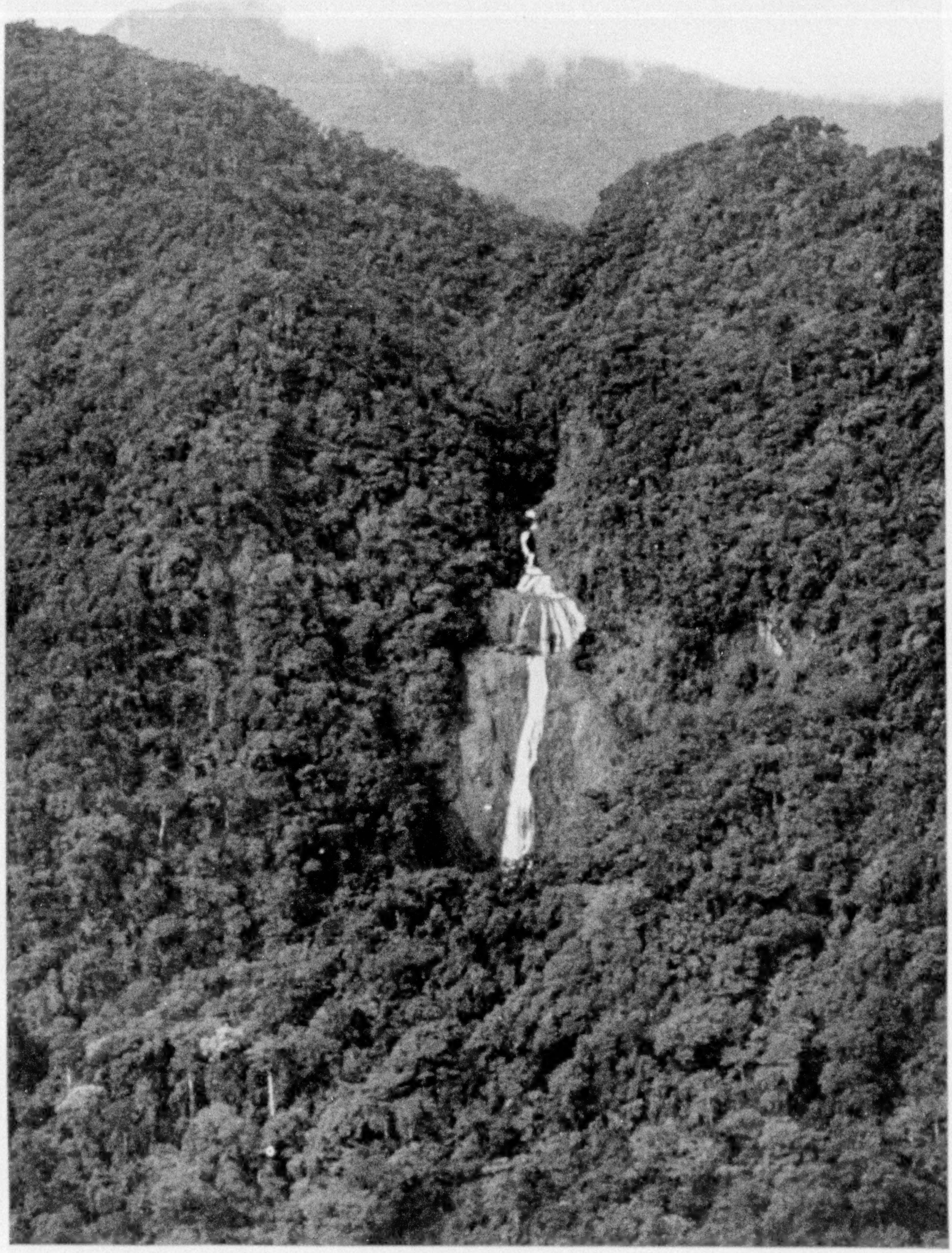
All of which shows what taking the wrong turning will do when luck is with you.

CHICKEN À LA MARYLAND AT LAST

The last echo of our Jugoslavian travels came several days later, when, just over the Hungarian frontier, we stopped in a village for lunch. Like so many villages in our immediate past, it offered nothing more appetizing than a sort of denationalized Irish stew. After lunch we encountered Laurence as he leaned over a fence inclosing some poultry. Gloomily he inquired, "I s'pose dey's *Gov'ment* chickens?"

"Oh, no," we told him. "We are out of Jugoslavia." And Laurence seemed to breathe a sigh of relief.

Far be it from me to inquire into Laurence's private affairs. I only know that that evening—we were still in the zone of unappetizing food—he presided in the kitchen of our inn, and that we all, Laurence included, dined magnificently on chicken à la Maryland.



IN THE HEART OF PRIMEVAL WILDERNESS ON THE ISLAND OF LUZON ROARS A 500-FOOT WATERFALL

This cataract, more than twice as high as Niagara, was found by members of the Sixth Photographic Section, U. S. Army, and named for Hon. Henry L. Stimson, then Governor General of the Philippines, and now Secretary of State.

THE UNEXPLORED PHILIPPINES FROM THE AIR

Map-making Over Jungle Lands Never Before Seen By White Men

By Lieut. George W. Goddard, U. S. A.

With Illustrations from Photographs by the Author

THE Philippine Islands are not all so thoroughly civilized and so thickly populated as Americans generally believe. Approximately 25,000 square miles of insular territory, most of it mountain jungle land, is listed on Government survey maps as "unexplored."

We of the Sixth Photographic Section, U. S. Army, at Nichols Field, near Manila, were glad of the opportunity for a flying expedition over a strip of this unexplored land in the northeast corner of the island of Luzon, largest of the Philippines, on the west coast of which Manila is located. We set out one sunny morning with three Army airplanes for extensive work in aërial photography and photographic mosaic map-making.

Always there is a thrill of interest in flying over territory one has never seen before. We could not tell what might be revealed. But it was only too easy to see that a forced landing would have entailed risks other than the usual hazards of such experiences.

PHILIPPINE MAHOGANY MARKETED BY THE JAPANESE

Lumbering in this district is largely in the hands of Japanese. We saw a freighter flying the Japanese flag lying off the coast and loading Philippine mahogany taken from the more easily accessible forests along a river and floated down to the sea. The logs taken out are five and six feet in diameter, and are floated out to the ships on bamboo rafts. Some of the finest cabinet woods in the world come out of these dense jungles.

The purpose of our work was threefold. We were to gather information, mostly photographic, that would enable the Bureau of Forestry of the Philippine Government to make a timber survey. The Bureau of Lands also was anxious to determine if any of this territory might be parceled out to settlers. It adjoins the fertile valley of the Cagayan River.

Our most important objective was to furnish the Coast and Geodetic Survey with a set of photographs to be used as plane-table sheets.

We succeeded in photographing altogether about 5,000 square miles; also we found and photographed a 500-foot waterfall—never before seen by whites so far as we know—which we named for the then Governor General of the Philippines, Henry L. Stimson (see opposite page).

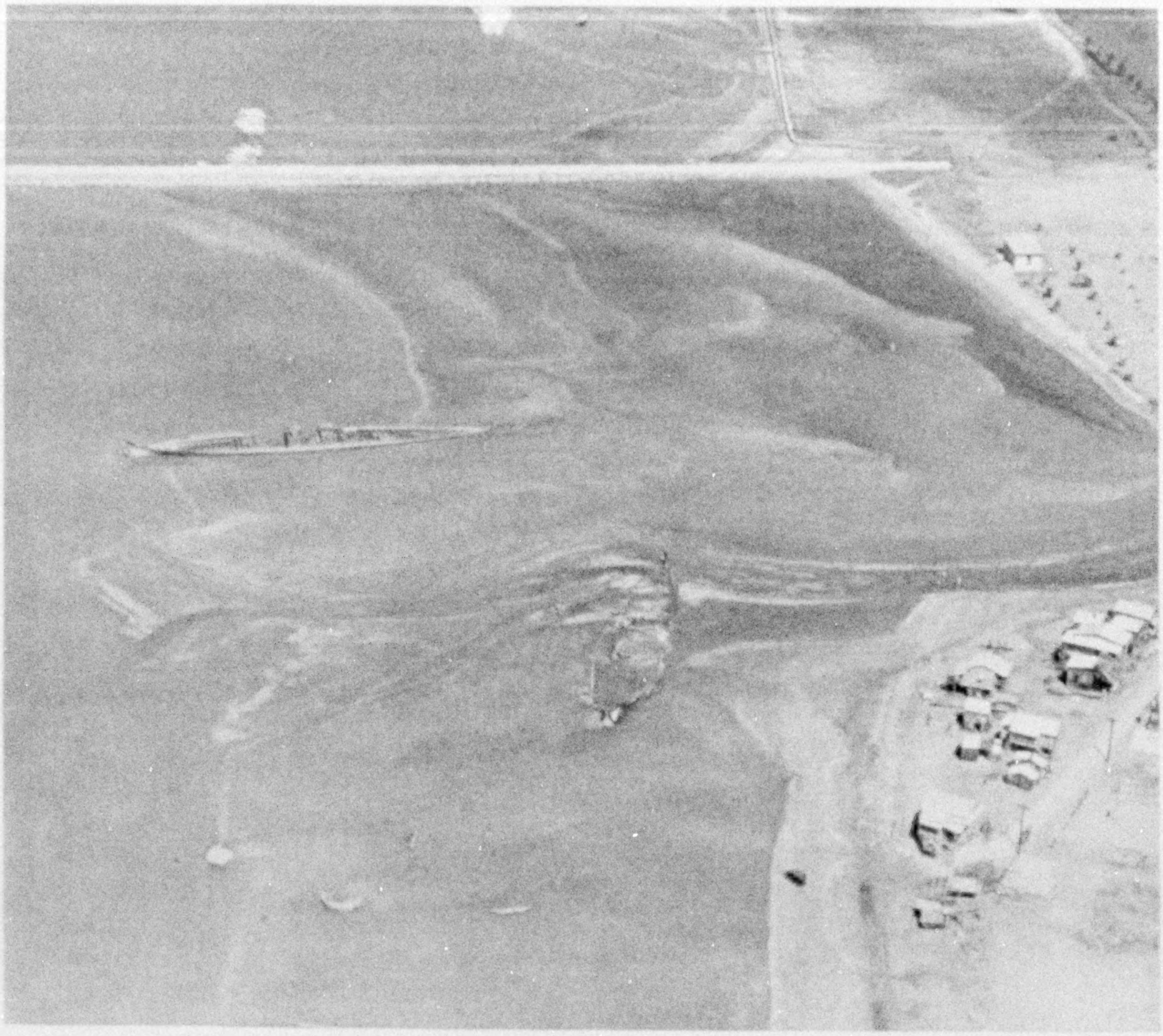
Previous photographic work of a similar kind on the island of Mindoro, and on the Bataan Peninsula, west of Manila Bay, had given us some idea of what to expect. Our greatest risk was in a possible forced landing.

In actual mapping work, Lieut. H. R. Wells and I were to pilot two De Havilland photographic planes, each carrying a noncommissioned officer to operate the cameras. We planned that we would always fly together, so that in case of a forced landing on the treetops, the other plane could go back to the base and send out the Martin bomber with mattresses, mosquito netting, cans of water, emergency rations prepared in tins, and rifles and ammunition enough to last us until rescuers could bolo a passage through the jungle to us.

We would have to drop with parachutes, of course, if anything happened, and we planned to spread these 'chutes out on the treetops as markers and use our smoke flares so the bomber could find us.

SUPPLIES TIED TO WINGS OF PLANES

The two De Havillands and the two-motored bomber started out from Nichols Field so heavily loaded with mail, equipment, and supplies that we were somewhat doubtful whether they would leave the ground. On the De H's we even had



HERE REST THE GUNBOATS SUNK BY ADMIRAL DEWEY

Mute reminders of the Battle of Manila Bay lie offshore from Fort San Antonio Abad, a part of which may be seen at the upper right. The construction work in the background is the new breakwater.

boxes of stuff tied to the wing surfaces next to the fuselage. The big plane had more than a ton of supplies on board.

Nine persons in all made the trip, including a news reel cameraman, aërial photographer, and mechanics.

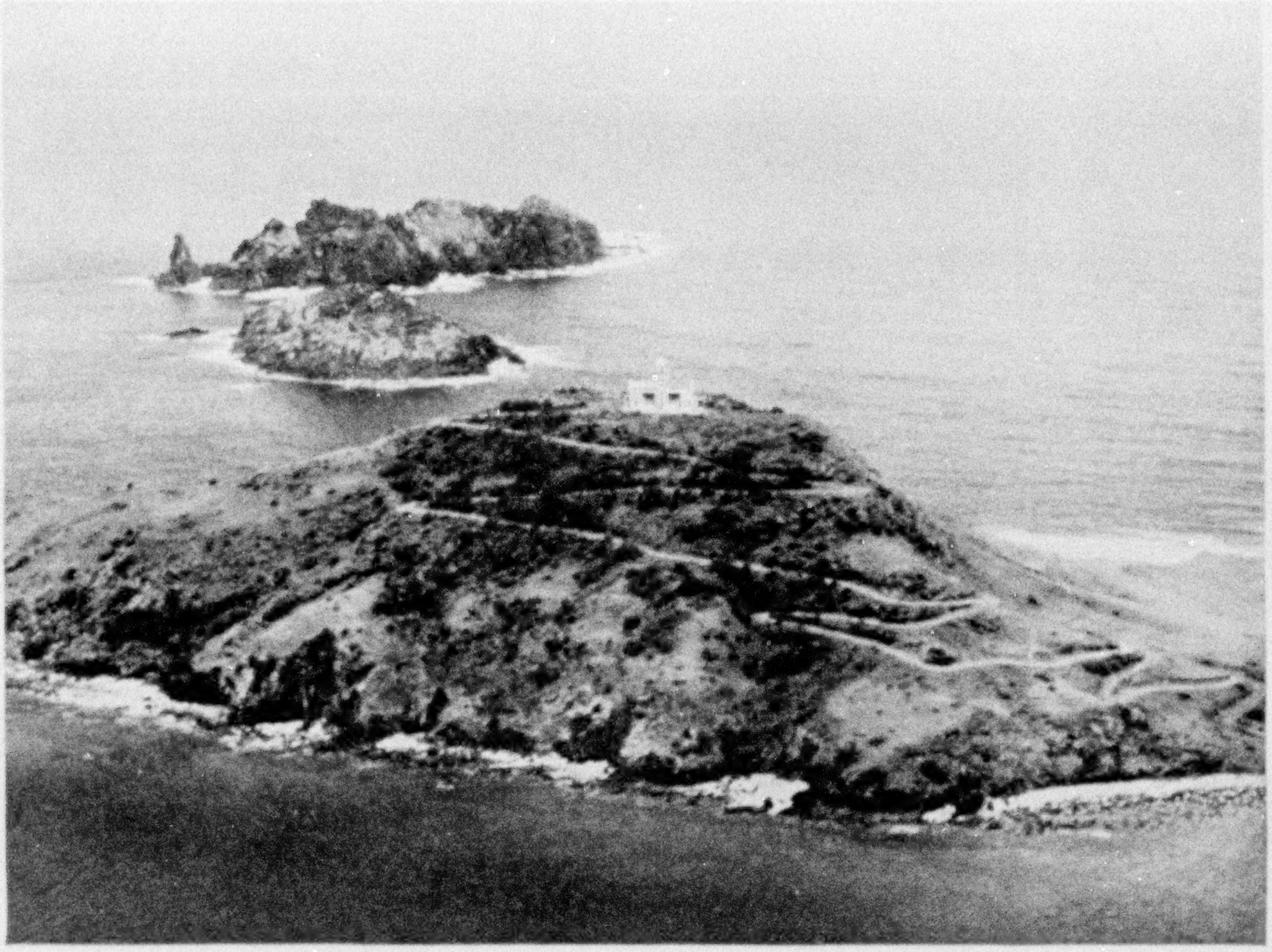
We flew due north to Aparri, northernmost port of the Philippines, which was to be our first base of operations, making the journey, 350 miles, in three hours and fifteen minutes. On a boat, the trip takes four days. The flight gave Philippine postal officials some idea of what might be done with air mail service in the Islands.

On the way up, passing Mount Arayat, about 50 miles out of Manila, we got a taste of bumpy air that was to bother us many times later. Wind currents sweeping up out of the warm valleys cut some queer capers when they strike cross currents over the mountain tops. We were flying at about 6,000 feet, and it was all we could do to stay in the ships. These same tricky currents added to difficulties by forming cumulus clouds through which it was impossible to take photographs. They spoiled many a day's work for us later on.

The main part of this journey to Aparri was over beautifully cultivated land, the famous rice terraces of the Bontoc region and the tobacco lands of the Cagayan Valley, laid out in great squares of green.

APARRI IS THE JUMPING-OFF PLACE FOR CHINA

Aparri is the jumping-off place for China and Japan. Also it is in the path of most of the typhoons originating near the island of Guam. These follow a fairly regular



PALAUI ISLAND LIGHTHOUSE, ONE OF THE MOST WESTERLY OF AMERICAN GUIDES FOR COMMERCE

Typhoons originating near Guam sweep past this point off the northeastern end of Luzon and menace the traffic with China and Japan (see text, page 315).

course, sweeping across the northern Philippines and the China Sea, then up the China coast. Fortunately, we were a little ahead of the typhoon season, but, as an emergency precaution, we made arrangements with the constabulary to store the planes and equipment in an old Spanish church built of stone, not far from the landing field, if the need should arise. The old padre was very accommodating, agreeing to hold up services if necessary to get the planes inside. We drilled the crew for a quick take-down, and were pretty well prepared.

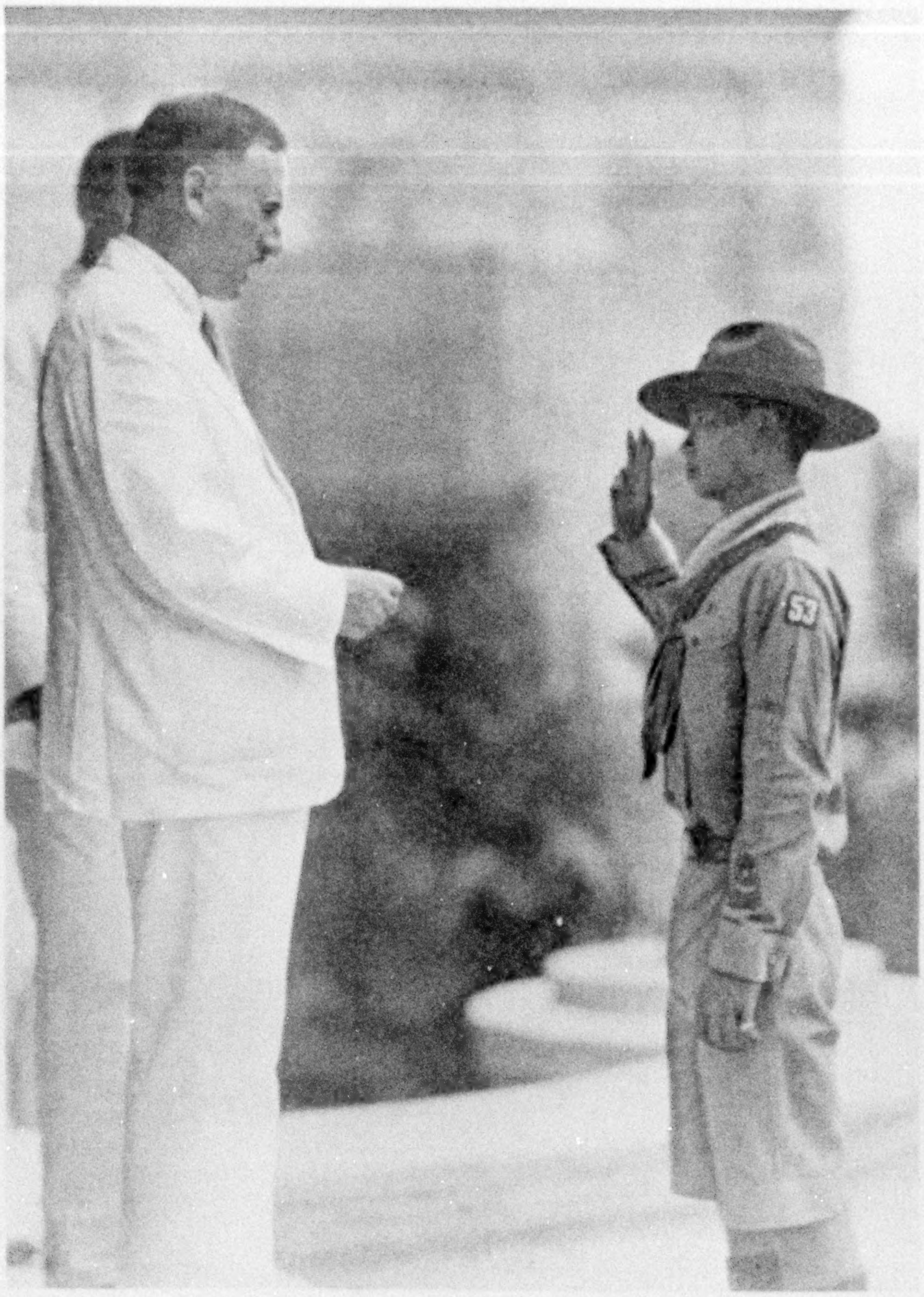
The crowds that turned out to see us in Aparri caused us a little nervousness. Young and old, sick and well, came from miles around, riding carabaos, ponies or any available conveyance, whole families and tribes of them. We engaged constabulary guards to watch the ships and the stores night and day, for souvenir hunters are not confined to the mainland.

But the curiosity made manifest here was mild compared to that of the really wild natives with whom we hobnobbed down on the east coast.

WILD TRIBE FLEES AT SIGHT OF PLANE

On our first flight out from Aparri we had a glimpse of a wild tribe of unusual stature—for Filipinos. We had been up for about an hour, and had cut over east to the coast line, flying down very low over the rocky beach, not more than ten or fifteen feet off the sands, when we caught sight of these big people.

The first view we had of them showed little but their heels and backs. They were terrified by the great bird that swooped down out of the sky, and were making for the woods with all speed. We were going



DECORATING A FILIPINO BOY SCOUT FOR BRAVERY

The American official bestowing the award is Gov. Gen. Henry L. Stimson, who resigned that post in the Philippines to become Secretary of State.

when we came along in the plane. The men could run faster than the women and children, so the latter were left behind to escape as best they could. We left the lame and the halt and the weak and the small scrambling for the forest and went on about our affairs.

We began serious work the next day in the De Havillands, and found that the careful plans we had made for staying together in mutual protection against forced landing were highly impractical.

WORKING AT A 12,000-FOOT LEVEL

Our working level was as close as we could get to 12,000 feet. It took about an hour to reach this height. Lieutenant Wells and I, each with a man to operate the cameras, usually left Aparri between 6:30 and 7:00 o'clock in the morning, and flew for four or five hours a day.

fast enough to circle and come down on them before they had a chance to get far.

They were dressed about like the rest of the Philippine natives we saw, the main article of clothing being a cloth around the loins; but their houses were different. For protection against high winds they were built against the boles of big trees, lean-to style, made of nipa grass and palm fibers. Careful construction would be wasted effort, for the typhoon devil destroys their dwellings several times a year as it is.

We could see the cooking fires they left on the beach. All their belongings were scattered about in their haste to get away

We found that we could stay together until we reached the working level and started shooting pictures, but after that we soon became separated. Flying at more than 100 miles an hour, and with so many things to keep in mind, we would forget to keep watch for the other plane. We simply had to go it alone and hope the motors wouldn't fail.

Once I felt sure we had it coming to us. Sergeant Stockwell, my cameraman, and I had lost the other plane, as usual. There must have been some water in my gasoline. We were about half through the morning's work when the motor sputtered and almost stopped. I figured we had enough altitude to get to the Pacific on the east side of the island, so we turned around and started a long glide. I switched over to my emergency gasoline tank in the upper wing of the airplane and pumped frantically.

We made the coast line, but when we reached it, one look at the enormous swells dashing against the rocks made me wonder if we wouldn't have done better to make parachute jumps back where the motor started missing.

These swells, some of them 20 feet high, do not appear on the China Sea side of the island. From the air, they make a great white streak along the coast, but looking at them closely gives another impression entirely. It looked like suicide to try them in a land plane, but the rocks on the beach were worse. Just as I was getting ready to take a deep breath, the motor started to pick up again and allowed itself to be nursed back to life. We headed back for Aparri and landed safely.

Lieutenant Wells (Deacon, we called him, because of his ministerial ability) came in half an hour or so later with another experience. He had found a 500-foot hole in the air, close by a mountain top. He was flying along at the working altitude of 12,000 feet when suddenly he commenced to settle, and his altimeter went down 500 feet in a few seconds.

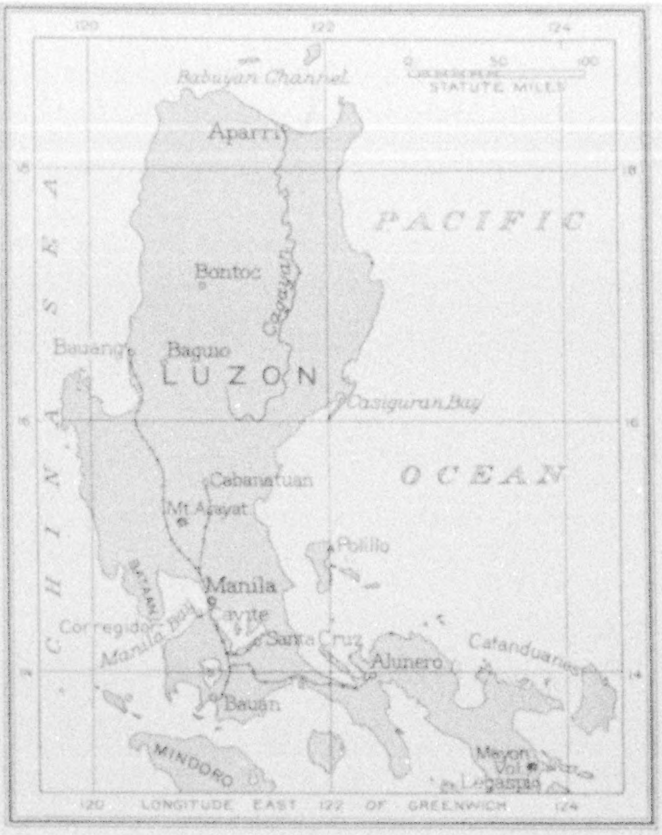
I went back the next day after we had taken the water out of my carburetor and gasoline tanks. It couldn't be done. She just wouldn't pick up.

We both flew over the same area later, and with the same experience. That hole in the air stayed in that same place day after day, and as it was an important location for pictures, we spent some hours trying to conquer it. We never did.

This is a typical example of the kind of difficulties that beset air photography in the Tropics. One has to know his air currents.

FLYING LABORATORY AIDS WORK

Our photographic work was greatly aided by a portable flying laboratory which we brought along in the bomber. We set this up in the field under a tent soon after landing and prepared to make tests of our film on the spot, so we could tell just what we were getting.



Drawn by James M. Darley

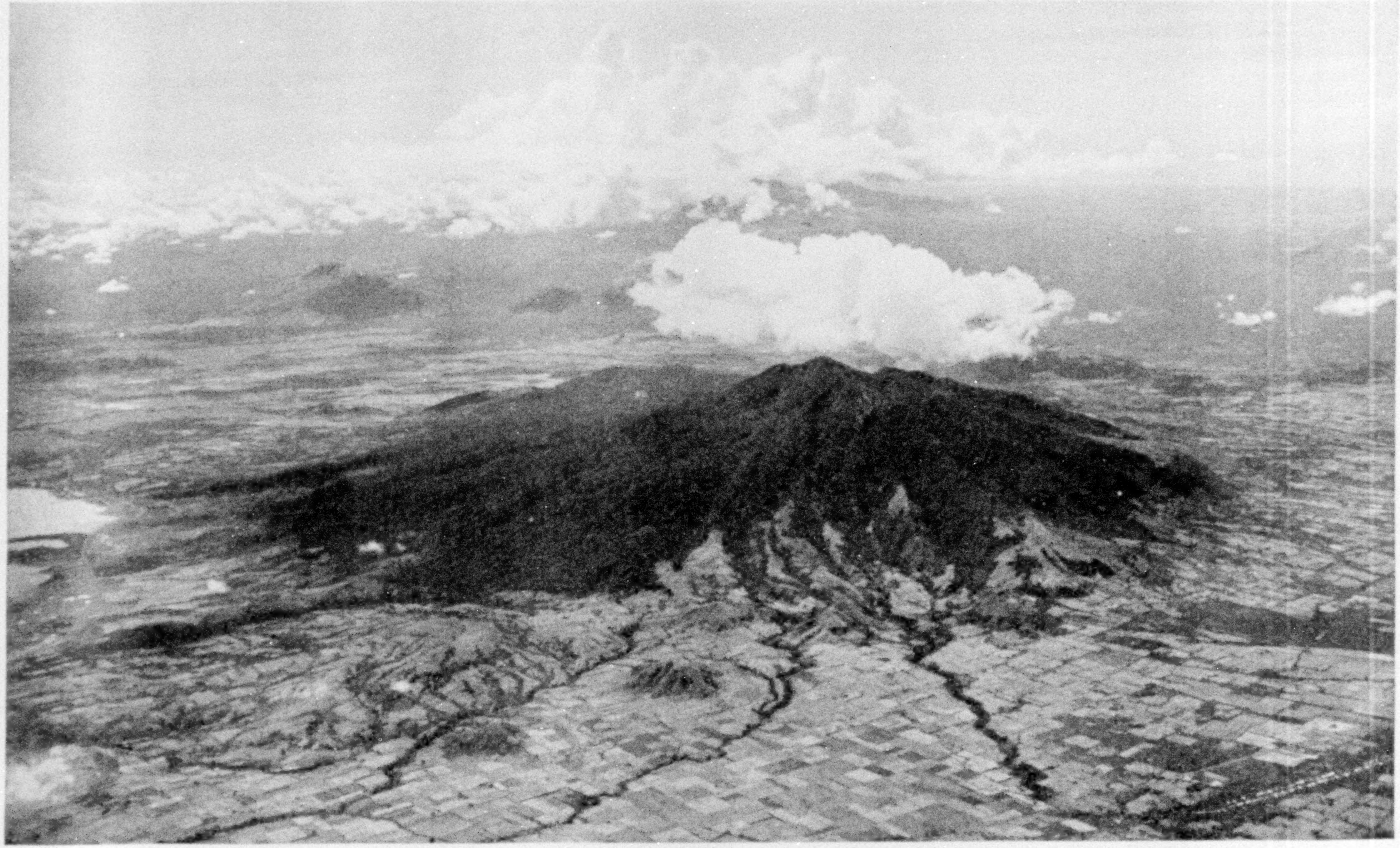
THE NORTHERN HALF OF THE PHILIPPINE ISLANDS

The author's photographic party established its airplane base at Aparri, and did much of its 5,000 square miles of aërial surveying between the eastern coast and the Cagayan River. Another base was established subsequently on Casiguran Bay.

This laboratory had been planned and built at Nichols Field. It included a collapsible dark room and all paraphernalia for making test developments, and it served the same purpose as the flying laboratory I had developed previously for use in the States, though the Philippine apparatus was small enough to be worked in the ship while flying, and pictures could be taken and finished in the plane in eight minutes.

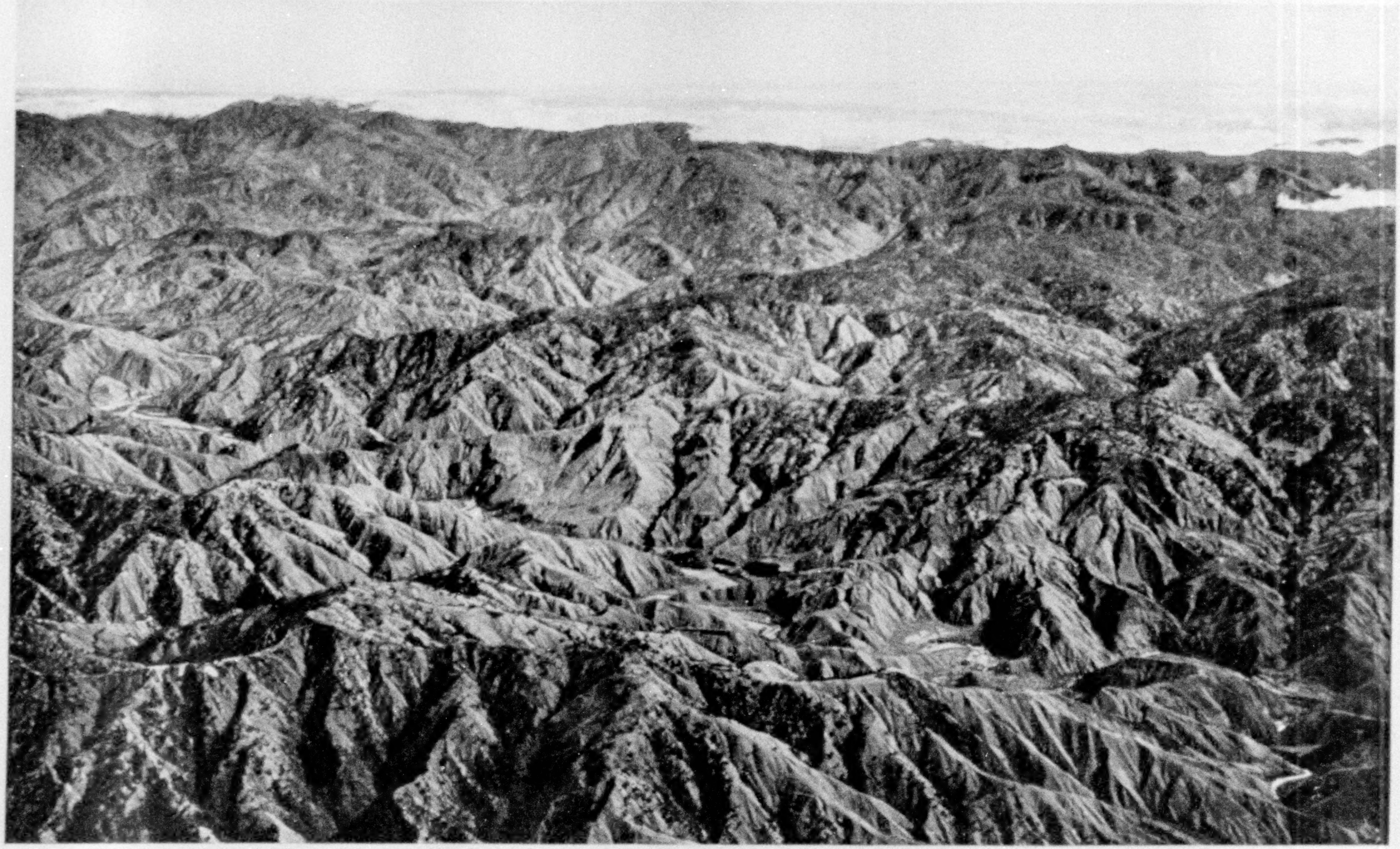
Through it all, the greatest difficulty was the weather. Regularly each morning, between 7:30 and 8:00 o'clock, clouds would form along the mountain tops. We came to expect them, know their approximate locations, and to learn to work around them whenever possible. In the Philippines we get our good weather all at once, with many of the best flying days crowded into March, April, and May. We had the best season for our work, but, even so, it was exasperatingly uncertain.

One day we heard a rumor of a typhoon moving up our way from Guam. It never did reach us, but it served as an introduction to the weather man of Aparri, who



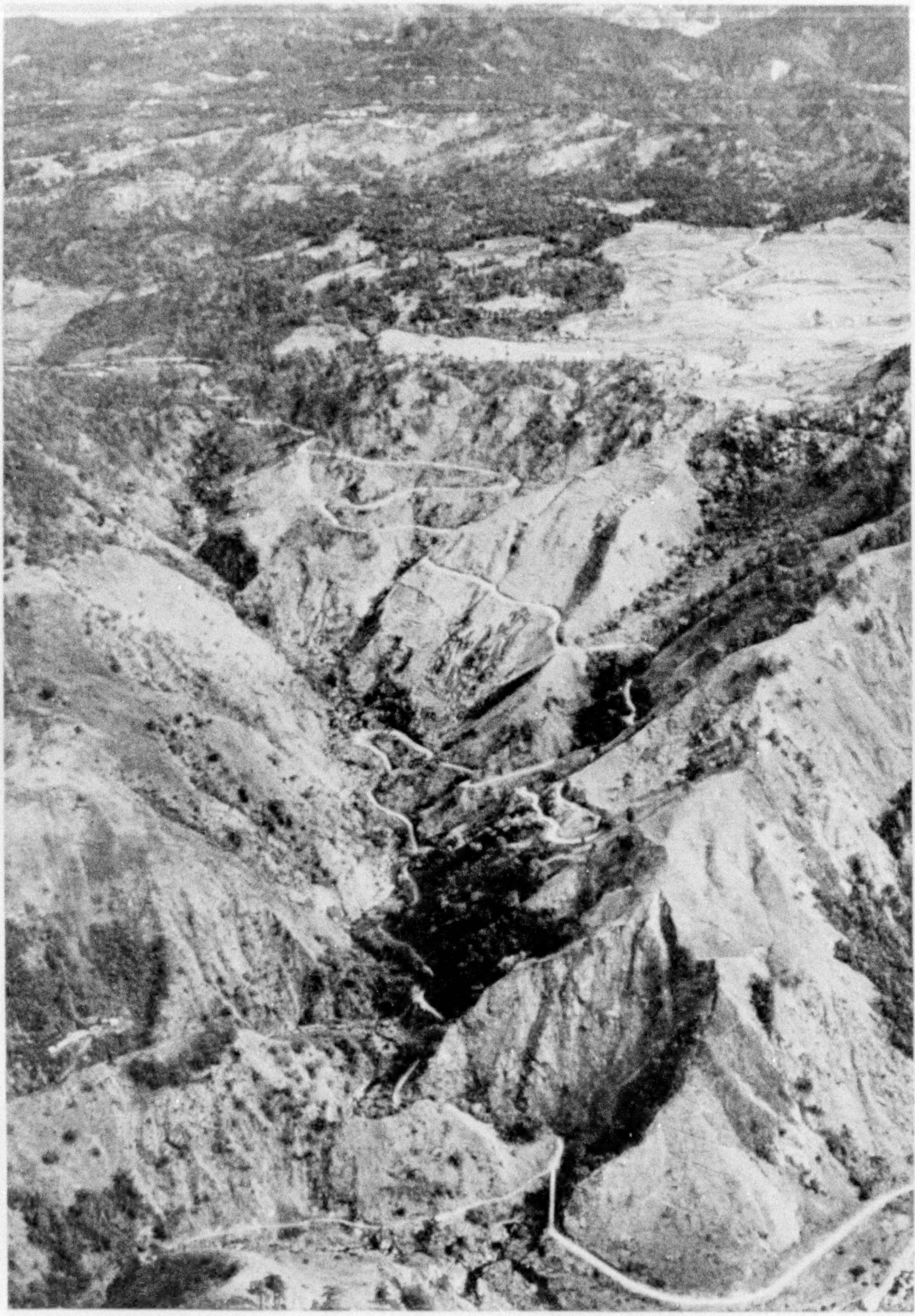
FROM AN AIRPLANE CULTIVATED FIELDS SURROUNDING MOUNT ARAYAT RESEMBLE A MOSAIC

The expedition passed over this extinct volcano, 50 miles north of Manila, on the way to the base at Aparri. Wherever topography permits, the primitive tribes of the Bontoc country engage in intensive agriculture, for the whole region is densely populated (see, also, illustration, page 322).



GOLD WAS FOUND IN THESE BENGUET HILLS MORE THAN A THOUSAND YEARS BEFORE MAGELLAN VISITED THE PHILIPPINES

Mines are still operated here. The river cutting through the rugged waste is the Agno. Some settlements surrounded by small irrigated fields may be seen along the stream. As such topography is not conducive to safety in case of a forced landing, the survey party was flying at an elevation of 12,000 feet when this photograph was made.



BENGUET TRAIL AFFORDS A SMOOTH MACADAMIZED HIGHWAY TO BAGUIO

Though the road was less than 30 miles long at the time of its opening, it cost nearly $2,000,000. The expense account indicates the tremendous engineering difficulties the rugged country imposed on the builders. Even to-day, native laborers are constantly at work breaking rock for repairs (see, also, "Some Impressions of 150,000 Miles of Travel," by William Howard Taft, in the NATIONAL GEOGRAPHIC MAGAZINE for May, 1930).

turned out to be one of the most interesting characters we met. We went up to see him about that alleged typhoon, got to talking with him, and went back almost every day thereafter.

He was an old Spaniard with a long beard and a wizened, weathered face. I think he has the stormiest job in the world. His little shack, built halfway into the ground like the natives' huts on the small islands north of Luzon, is directly in the path of nine out of every ten typhoons originating in the typhoon cradle near the isles of Guam and Yap. No ordinary structure can stand the force of the wind.

We used to go up and try to talk him into giving us some good flying weather, but with little progress.

"No, sir," he used to say in his broken English, "you can't talk me into any good weather. If it isn't there, you can't have it, that's all. You can take it or leave it. Now, if you'd come along when we had that typhoon in 1906——," and then he was off on some of his reminiscences. He liked to describe what would happen to one of our planes if a typhoon should hit it. Our best chance of landing would be off in China, 400 miles to the northwest, he thought.

FLYERS FIND THEMSELVES OVER A VOLCANO

Clear skies finally appeared and we were off for an area approximately 150 miles from our base. As usual, the planes became separated, but Stockwell and I proceeded with our picture work, shooting about a half roll of film before we were stopped by clouds which formed very rapidly.

The jungle was totally obscured before we had covered 50 miles of our homeward flight. We worked our way through the clouds and finally came out in a valley which ran in the opposite direction from our course.

Straight ahead was a mountain range with clouds hanging a few feet above and on the opposite side of this range we found ourselves over a volcano which we proceeded to explore. We flew around inside of the crater for several minutes taking photographs of the bubbling sulphur pool and clouds of steam which were belching forth from six or seven points.

The crater was big enough so that we could fly out of a large open place on one side and head for the landing field with another tale to tell. Later we went back again to take additional photographs of the volcano and its location. Nobody had ever seen it before, so far as we could learn. The crater is about 500 yards in diameter and about 4,000 feet above sea level. It is at the head of a line of volcanoes which run south through the Philippine Archipelago and the East Indies.

The best known of these volcanoes is Mayon, which we photographed two months later when it was in eruption and causing considerable alarm. The American Red Cross and Philippine Weather Bureau were extremely anxious to have aërial photographs taken of the crater and of the lava flow, so as to show definitely the seriousness of the situation. They requested assistance from the War Department and the mission was immediately assigned to the Sixth Photographic Section. Lieut. John D. Corkille, one of the Army's best pilots, was detailed to fly the mission and I was detailed to handle the camera work (see page 326).

Most of the trip southeast was over water, so we decided, for safety's sake, to use a Loening amphibian airplane. We left Manila at 2:00 p. m., June 30, with two aërial cameras, two standard motion-picture cameras, my 16-mm. home-movie outfit, emergency rations, and our life preservers.

AN ATTEMPT TO CLIMB OVER A STORM

The weather for 200 miles was ideal, but at a point approximately 50 miles from the volcano we ran into a severe thunderstorm, with black cumulus clouds extending up to about 12,000 feet.

We decided that instead of turning back we would take a chance and try to climb over the storm, so for the next 20 minutes we gained our altitude and started milling through the passageways between the clouds, which, as we proceeded, towered to 16,000 or 17,000 feet.

Estimating our direction and distance, we believed, after 30 minutes' flying, that we should be somewhere in the vicinity of the volcano. The clouds were now beginning to open up, which indicated that we had flown over the worst part of the storm, and, although we could not see the

FLOATING MAHOGANY LOGS MAKE LANDING PERILOUS IN CASIGURAN BAY

These great tree boles, brought to the port on bamboo rafts (right background), are ready to be loaded on a Japanese steamer (see text, page 311). The flyers nearly came to grief in taking off in the midst of such a flotilla.

ground, we managed to descend to 9,000 feet and spent the next half hour milling around.

All of a sudden, as we were passing along a very narrow opening between the clouds, our plane was thrown almost upside down. Cameras flew in all directions inside of the hull of our boat, and immediately we both felt a dry, burning sensation in our throats.

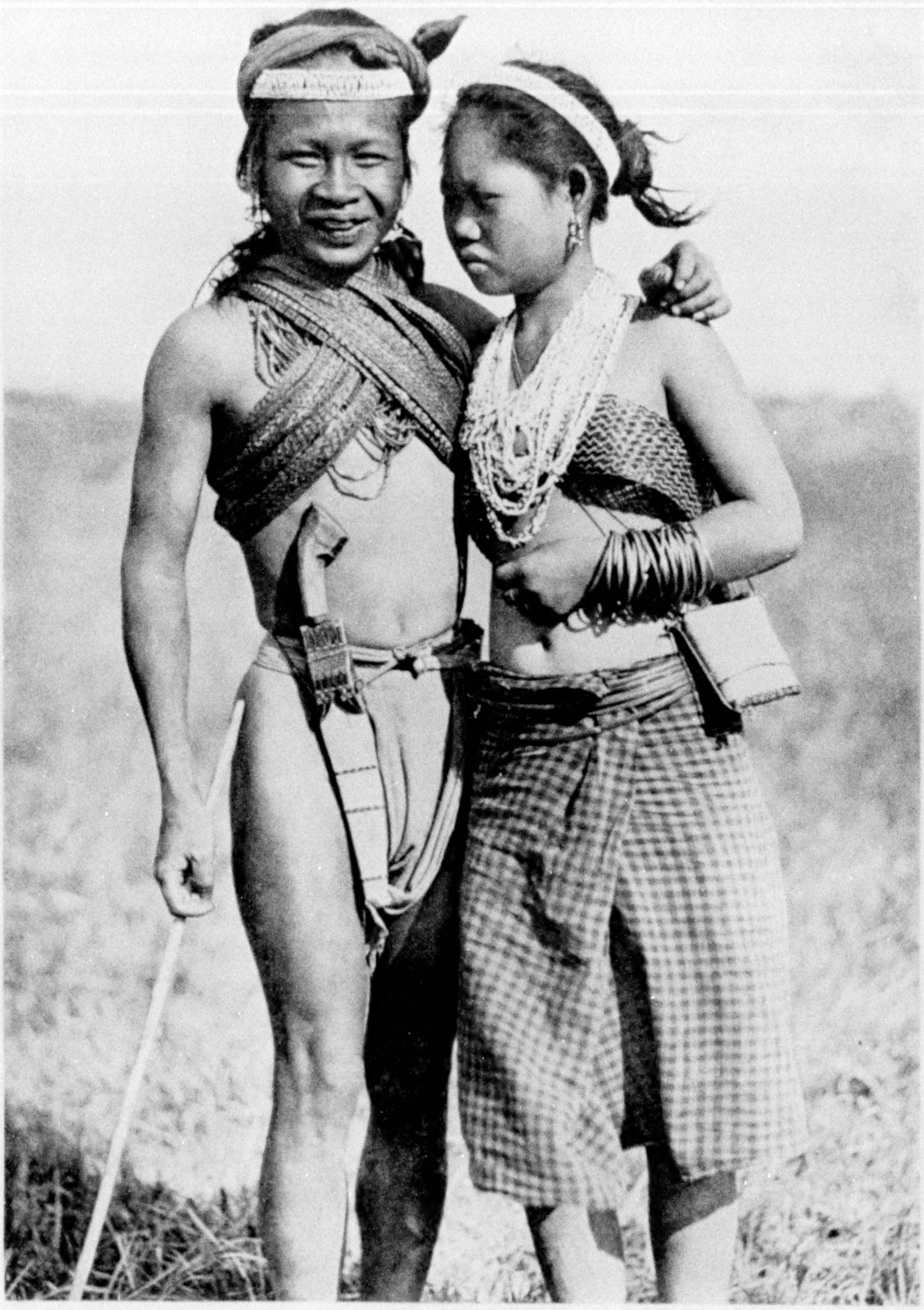
We knew for sure that we were very close to Mayon!

Before Lieutenant Corkille could right the plane, we were flying blindly in a cloud and minutes seemed like hours before we had worked our way out. We cautiously proceeded to climb where there was more room to maneuver. At last we were rewarded with our first glimpse of the volcano, with about 500 feet of its cone protruding through the clouds.

It was a magnificent sight to witness the flames, clouds of ashes and yellow smoke belching forth from the crater. In a few minutes, more of the volcano was visible and we could see the 300-foot stream of molten lava pouring out of the fire pit and running down the side of the cone.

The light at this time was so poor that photography seemed out of the question; however, we made a few single exposures at very slow shutter speeds, but did not attempt to take movies. We descended through rain and clouds, landing at Legaspi 20 minutes later.

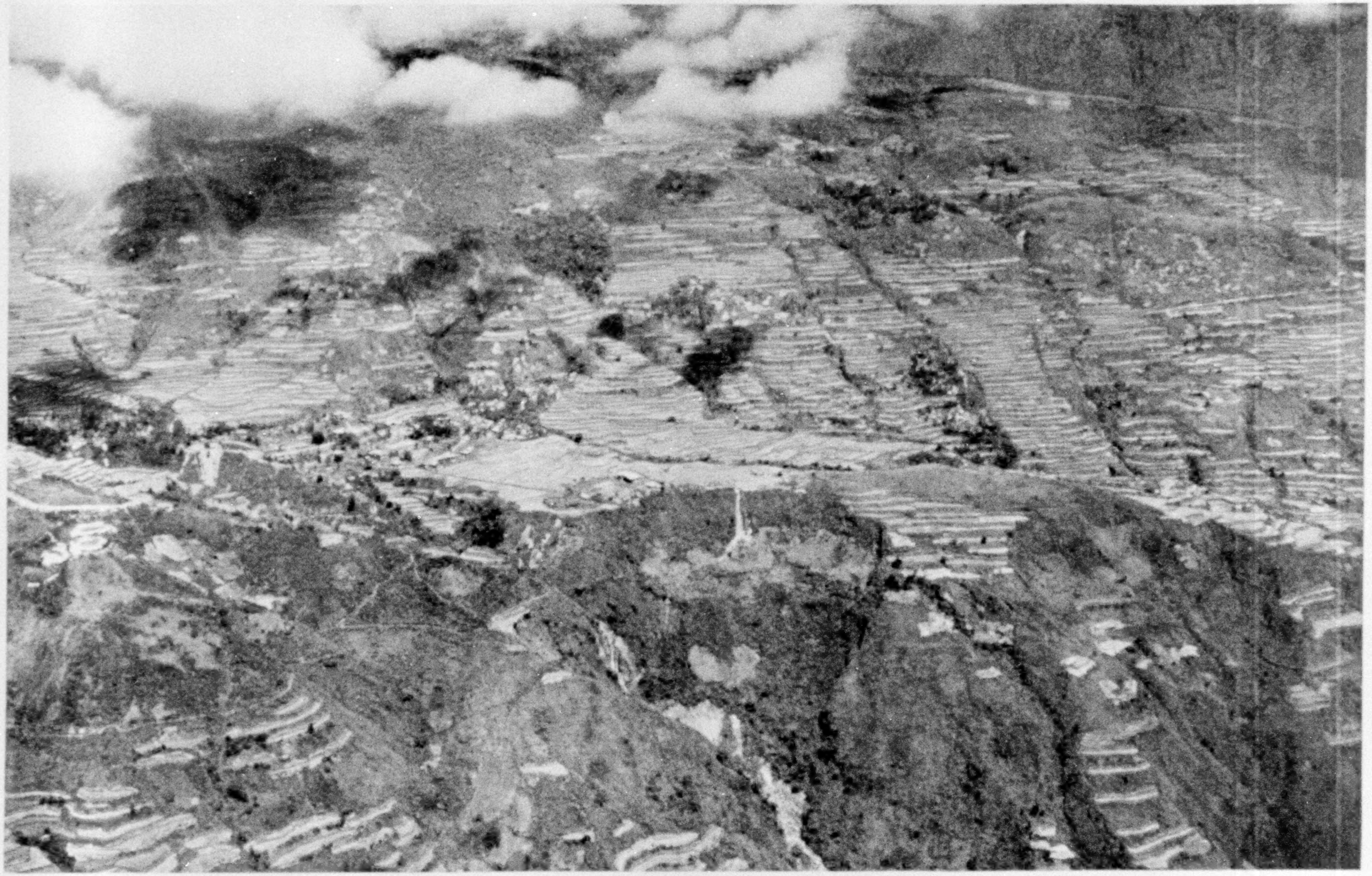
All night we watched the endless stream of refugees from the fury of the volcano, which presented an awesome but magnificent spectacle. The stream of lava which had appeared black to us in the air was now a river of fire. As it flowed it branched off into numerous streams. Occasionally an enormous white-hot rock was hurled high into the air with a terrible roar, leaving a trail of sparks as it rolled down the side of the volcano.



DRESSED FOR A HOLIDAY, A MANGYAN COUPLE VISITS THE FLYING FIELD

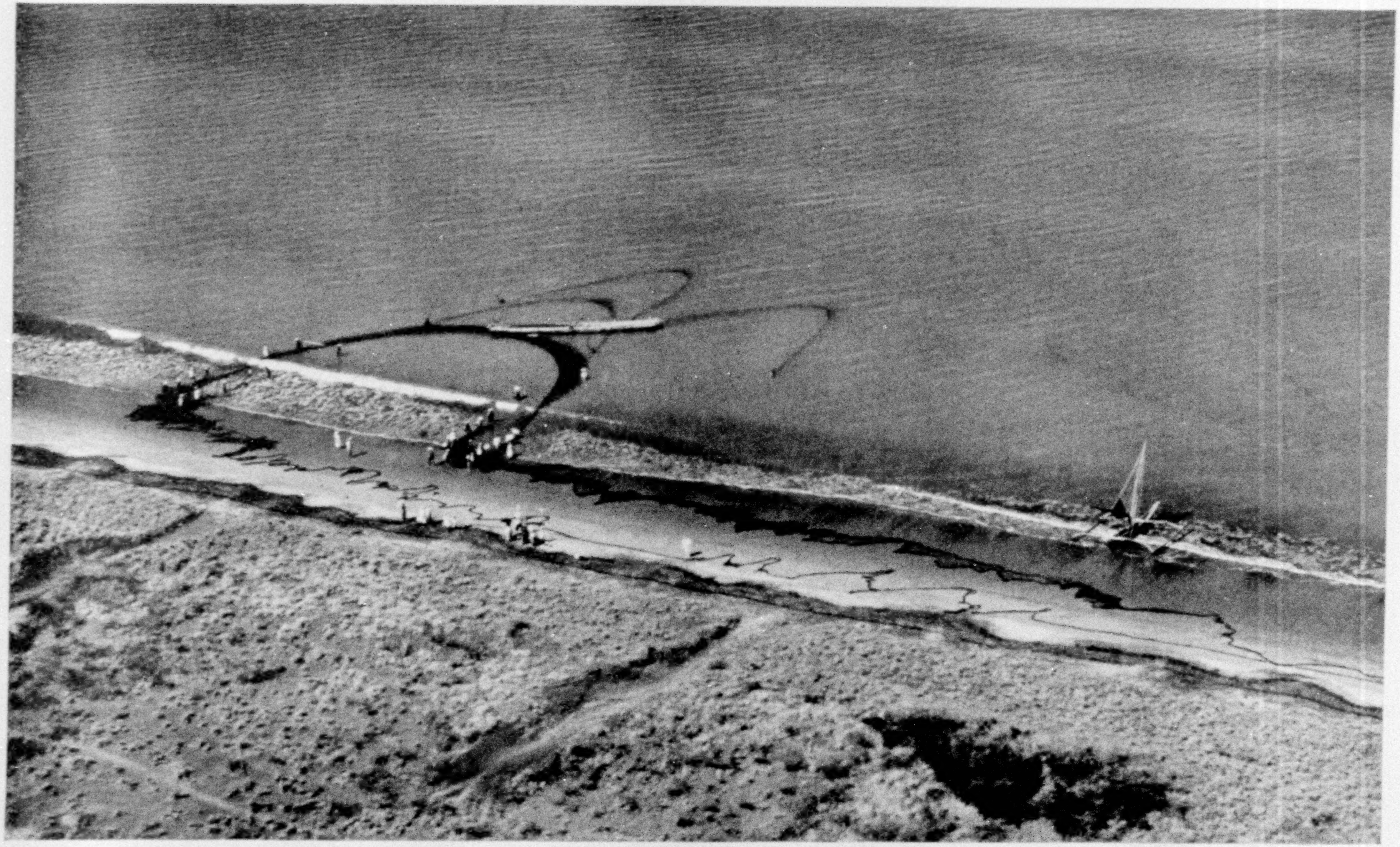
The tribe to which these young people belong is one of the most primitive in the Philippines, yet they have an alphabet, probably of Hindu origin, that has come down from their forefathers. Letters are written from left to right on banana leaves or joints of bamboo.

KUM



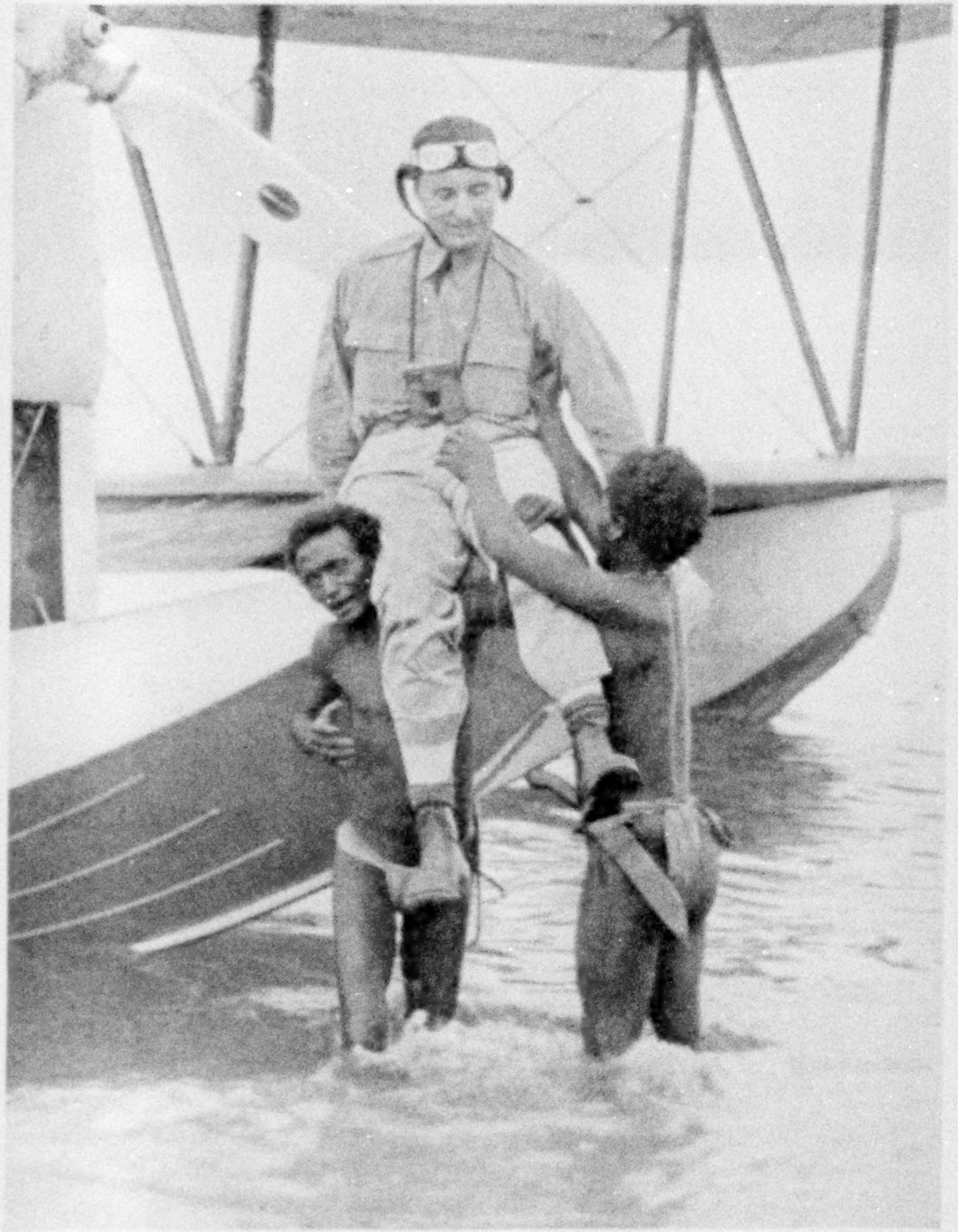
MASTERLY ENGINEERING FEATS BY UNTUTORED PAGANS BUILT THE RICE TERRACES IN THE MOUNTAINS OF LUZON

In the subprovince of Ifugao about 132,000 primitive tribesmen live on a plane area of 750 square miles, less than one-fifteenth of which is cultivated. This means that more than 2,000 people derive subsistence from each section of tilled ground. Working with wooden shovels, these natives have erected around their garden patches walls of dirt and stone a foot or more thick and often 40 feet high—walls which if placed end to end would extend half around the world at the Equator. The enclosures contain mud and water in exactly the right proportion, and are so constructed that excess water passes immediately to lower levels, where it is needed.



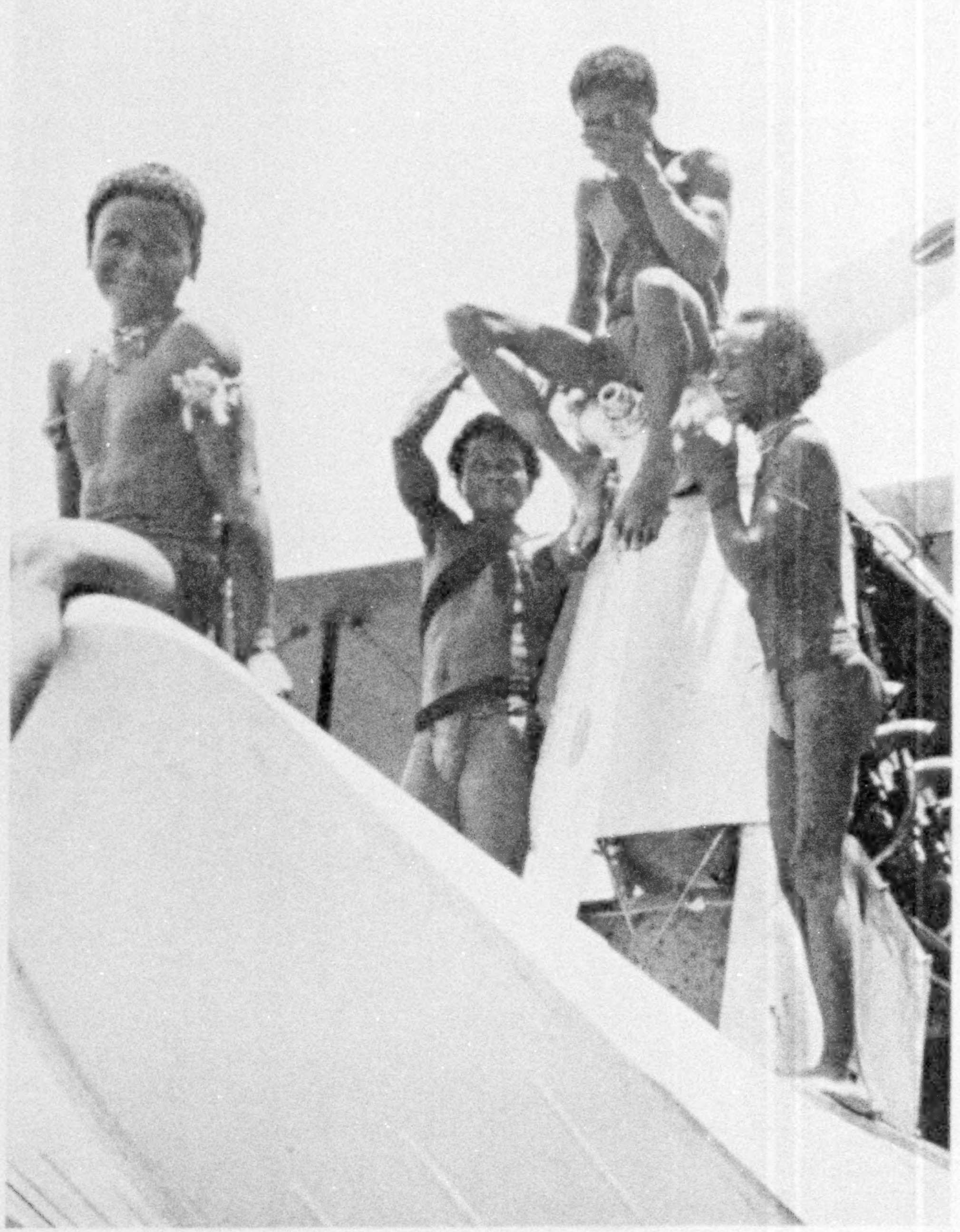
JAPANESE AND FILIPINO FISHERMEN AT APARRI USE ENORMOUS NETS

Here, as in the Dutch East Indies, many of the natives depend upon the sea for livelihood. An outrigger sailing canoe is beached in the right foreground.



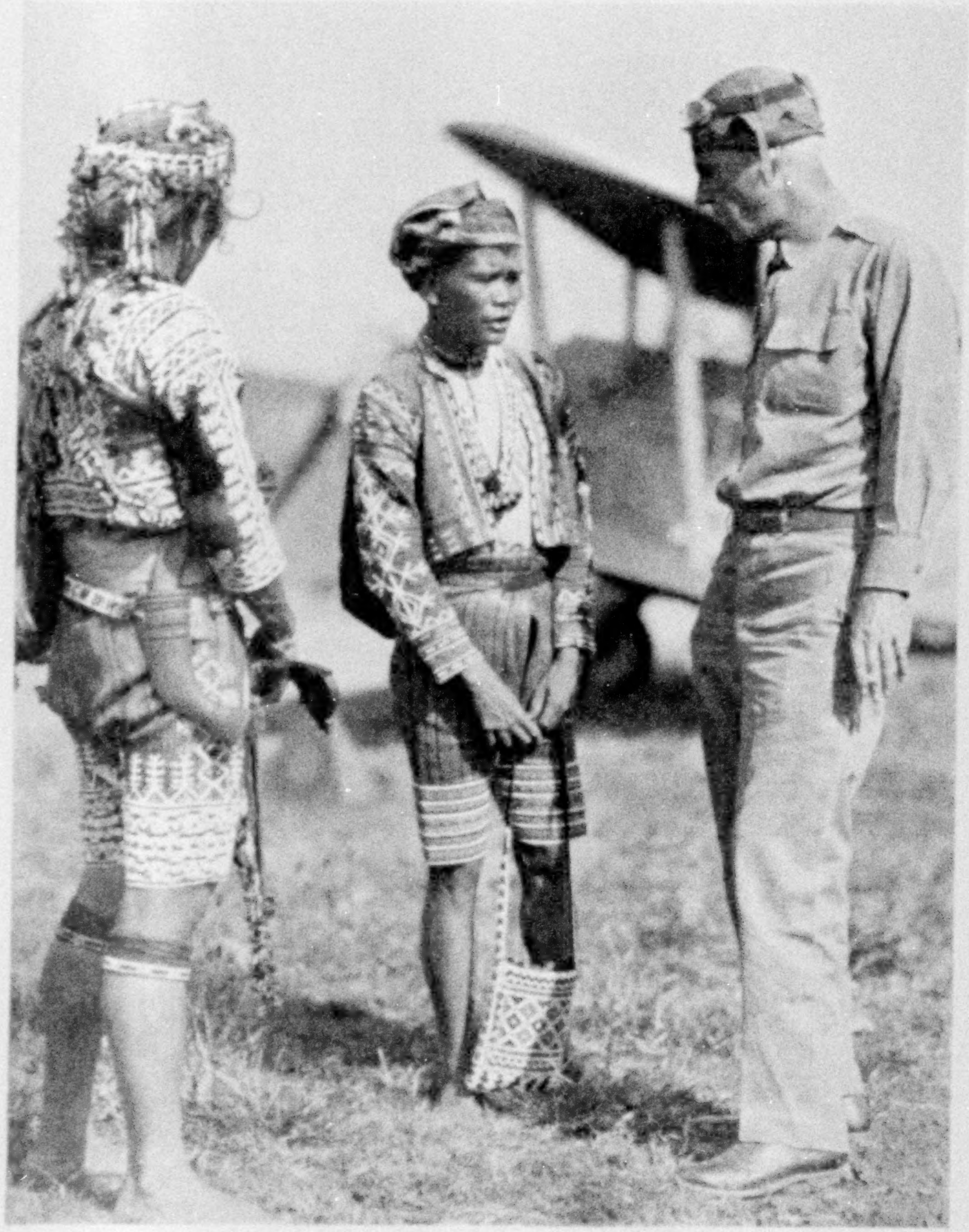
NEGRITOS CARRY THE "DEACON" ASHORE

In one flight at Casiguran Bay, the amphibian plane was brought down on a sandbar, and the natives transported the flyers to land (see text, page 333).



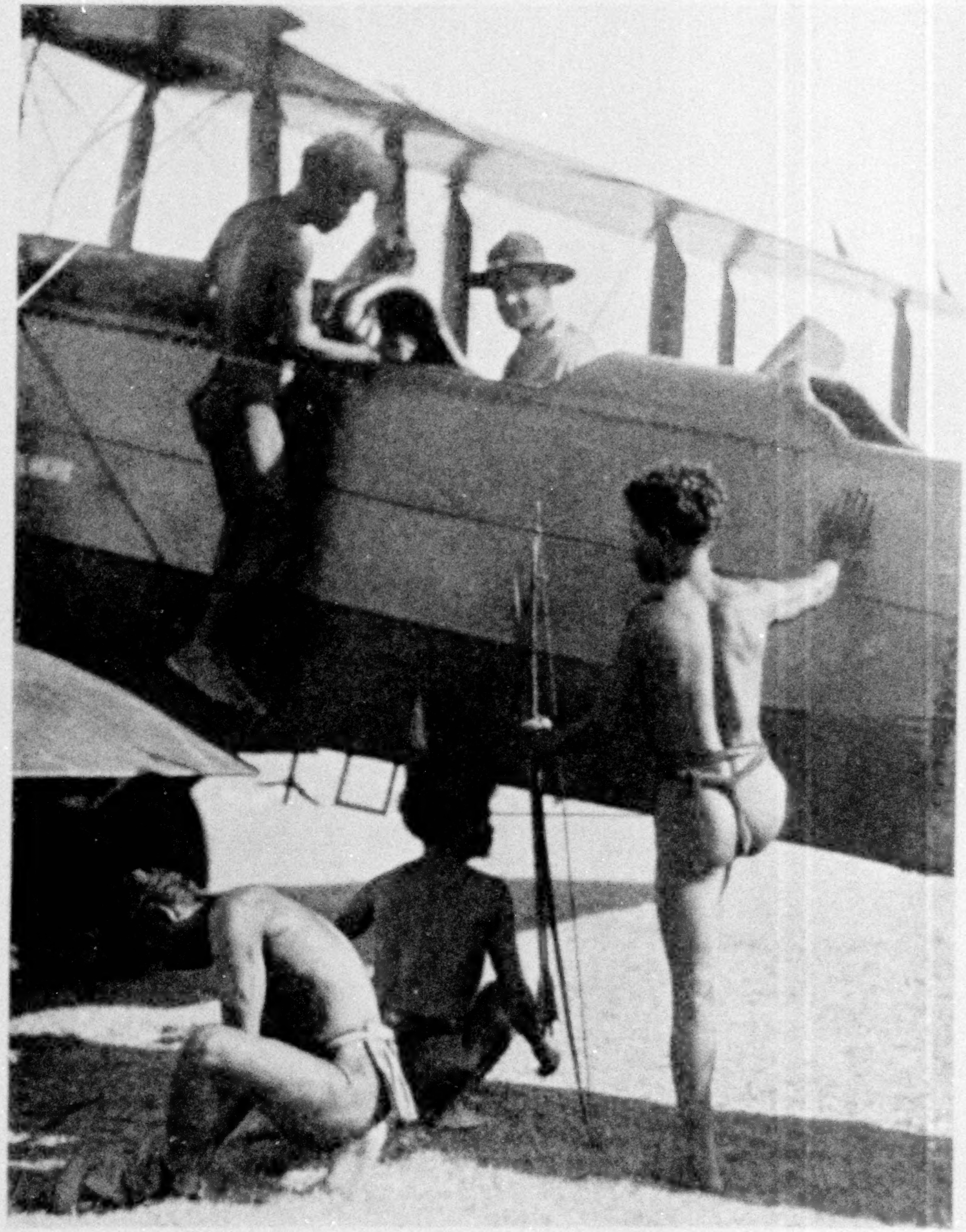
FAMILIARITY DISPELS FEAR

At first the Negritos at Casiguran Bay were afraid of the airplanes, but once convinced of the harmlessness of the "great birds," they clambered all over them (see text, page 330).



PAGAN BAGOBOS WEAR ELABORATE COSTUMES

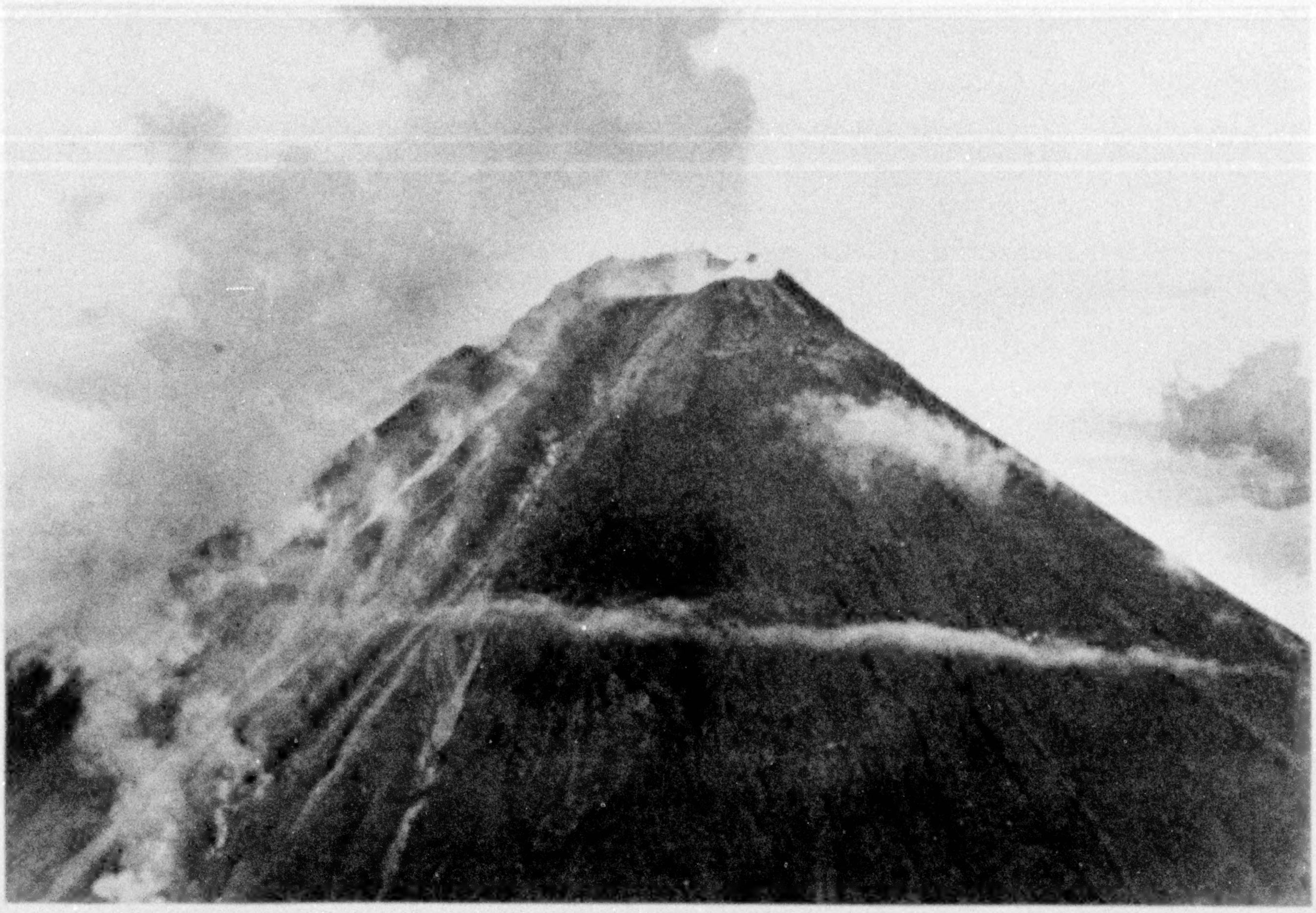
Tie-dyeing, embroidery, and bead work are practiced among these people, some 10,000 of whom live in Mindanao. The jackets and trousers are of woven grass cloth. Major John Duckworth, U. S. Army Medical Corps, is observing these natives' reactions after their first airplane flight.



Photograph by Merle Le Voy

HAVING THEIR FIRST VIEW OF THE "GREAT BIRD"

Negritos of Aparri, believing that the plane is some sort of fowl, are examining it for traces of feathers and other attributes of winged creatures. They cannot be convinced that the landing wheels are not a species of claw (see text, page 334).

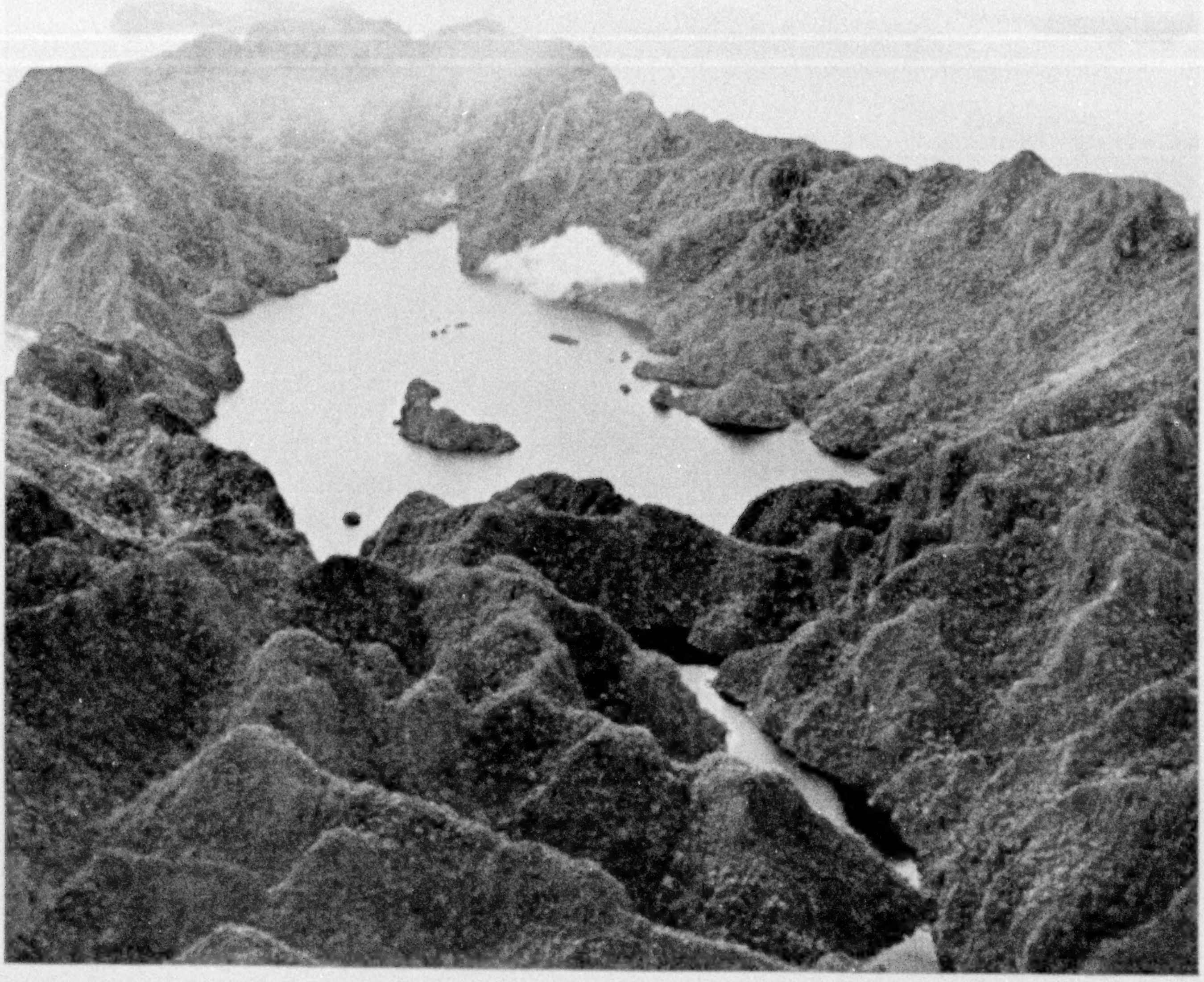


FLYING OVER MAYON VOLCANO IN ERUPTION PROVED A DANGEROUS UNDERTAKING

The author and Lieutenant Corkille had some exciting adventures in the tricky air currents above the crater (see text, page 319). They took this photograph early on a July morning.

RIVERS OF MOLTEN LAVA DROVE TERRIFIED NATIVES BEFORE THEM

When the Army relief plane reached Legaspi beach the aviators were met by throngs of refugees from the slopes of Mayon Volcano, the cone of which can be seen in the background.



U. S. Navy Photograph

CORON ISLAND IS A RING OF VOLCANIC ROCK AROUND A SMALL LAKE

Such formations are common in the Philippines. Because of the lack of safe areas for landing on the ground the flyers were obliged to use amphibian planes for much of their work.

The natives advised us to start out early in the morning if we contemplated taking pictures, because the clouds usually hid the volcano shortly after six o'clock. We were off at 5:00 o'clock and at 5:30, before the sun had appeared from behind the distant clouds, the motion and still pictures were being taken. Unfortunately, the volcano was passing through a quiet period, and did not present the sight we had seen the previous afternoon and evening.

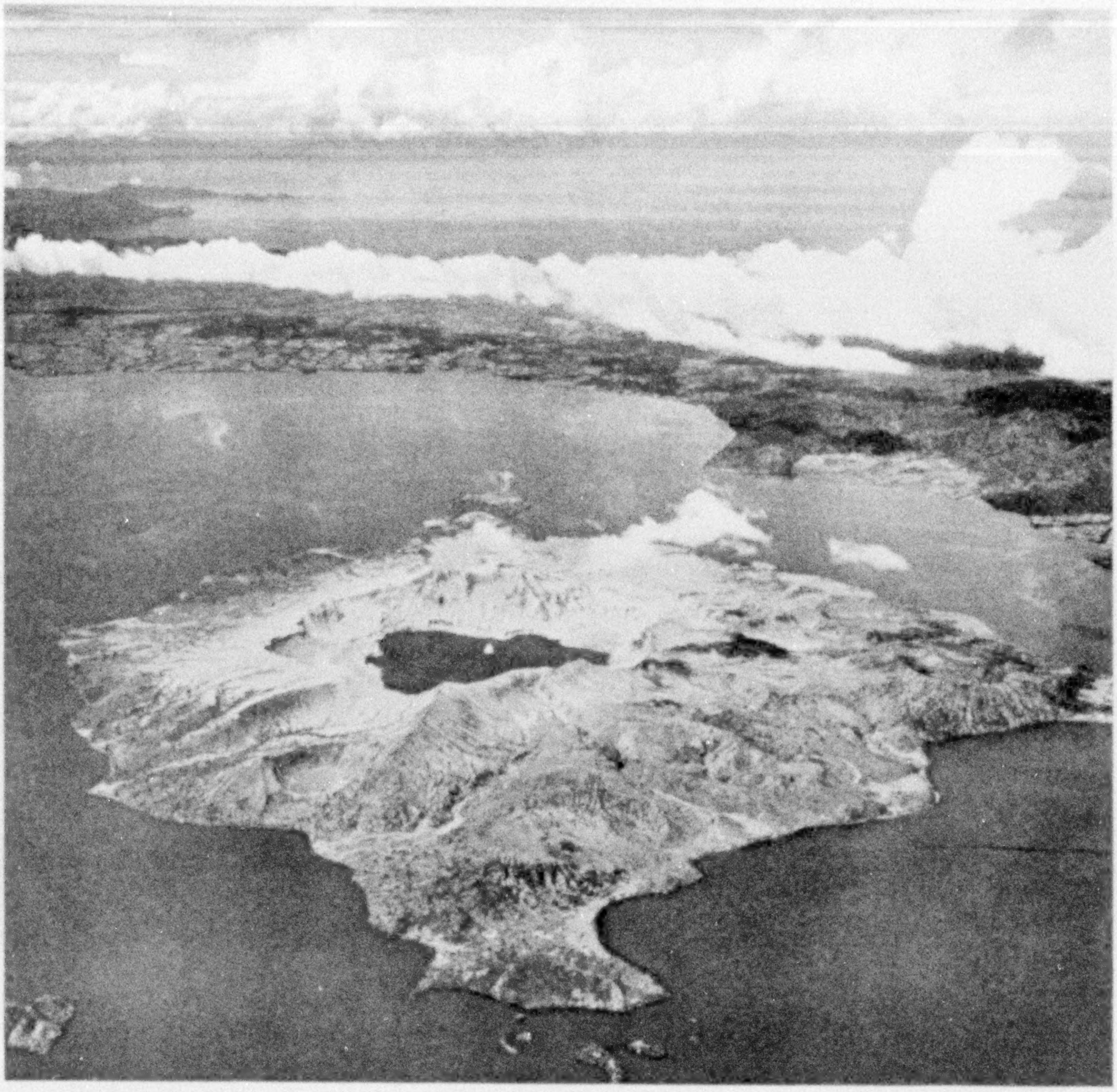
All of our photographs were taken shortly after six o'clock, and so we continued into Manila, where the pictures were printed and delivered to the newspapers and bureaus concerned.

FIGHTING LOCUSTS IN THE AIR

It seemed that whenever I went out and encountered something worth telling about, the Deacon came in with something just a little better. On one occasion he had lost himself and didn't show up until about half an hour after I had landed. While I was waiting for him, I noticed what looked like a great dark cloud moving in from the jungle area. It was an enormous swarm of locusts, attracted by our field—the only green place for miles around. In some years, before and during the rainy season in the Philippines, locusts are a great pest, doing incalculable harm to agricultural lands (see p. 334).

This cloud of insects kept coming toward the field and hovered over it, darkening the sky. Just then I heard the hum of the Deacon's motor.

He said afterward that he couldn't make out, squinting down out of the cockpit, what in the world was the matter with the field. It looked like heat waves from up



TAAL VOLCANO, WHICH KILLED 1,400 PERSONS IN 1911, NOW LIES QUIET

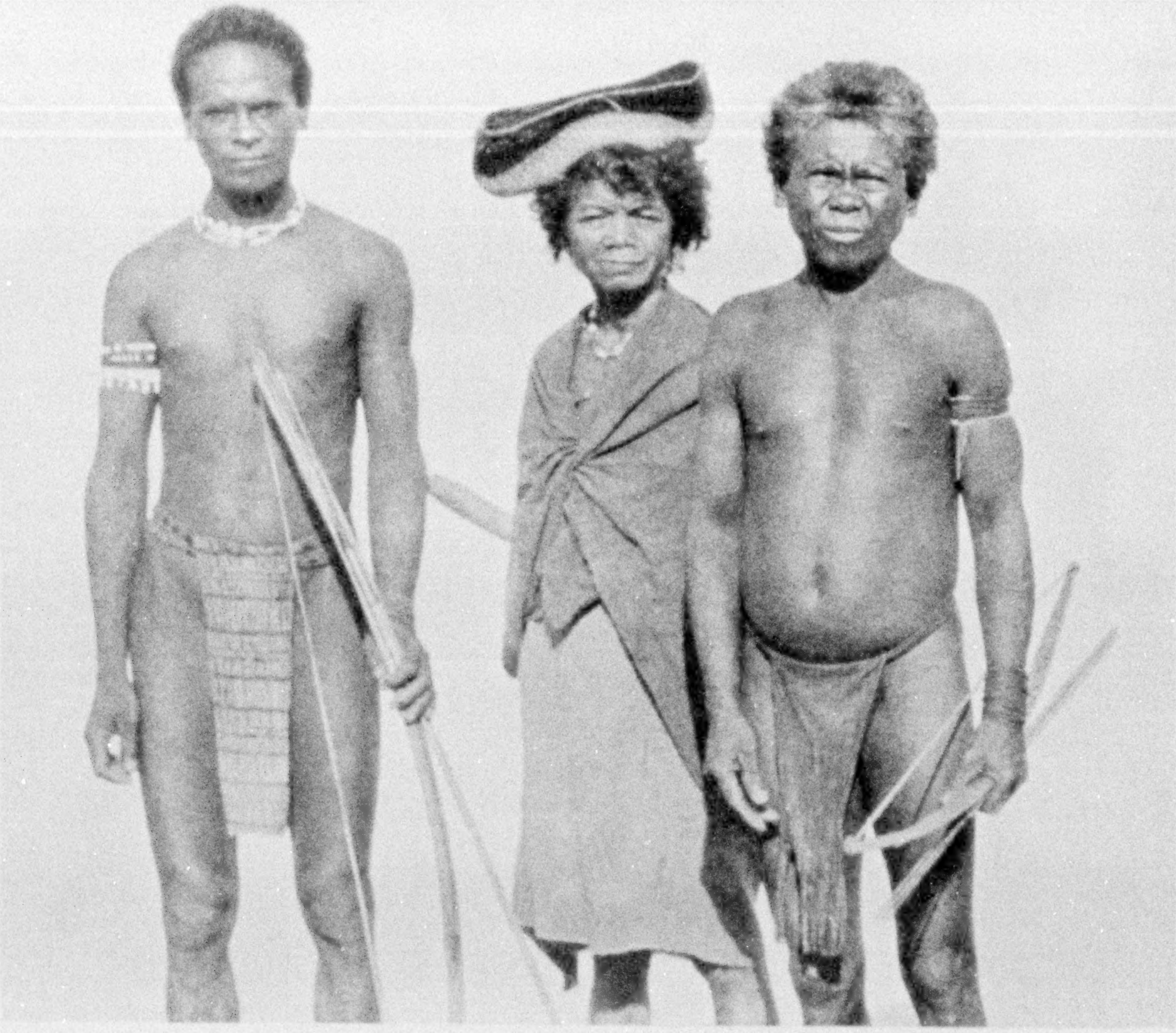
This sleeping dragon is on an island in Bombón Lake, only 39 miles from Manila (see "Taal Volcano and Its Recent Destructive Eruption," by Dean C. Worcester, in the NATIONAL GEOGRAPHIC MAGAZINE for April, 1912).

above, he said. When he came down close and saw what it was, he decided to fly into it. He made the biggest mistake of his flying career, right there. The locusts simply plastered the ship—flattened out all over it.

The Deacon's goggles were so splashed he couldn't see. The insects got into his mouth, nose, and ears. He zoomed up out of the danger zone instinctively and retreated to the sky to do some heavy figuring. Our landing field was the only place in northern Luzon where he could come down safely. He circled around for half an hour until finally the locusts settled down over the field and he could land.

It's an ill wind that blows nobody good. Our hazards provided a banquet for residents of the place. They came out with big baskets and gathered locusts to their hearts' content. Locusts are considered a great delicacy by some Filipino tribes, who pull the wings off and fry them.

Much the same thing had happened once when we were mapping the Bataan Peninsula (see text, page 311), only with bats instead of locusts. There is an extinct volcano in the area. We were flying very low trying to get pictures of it when an immense horde of bats, startled, I suppose, by the sound of the motor, came pouring out of rock crevices. They plas-



TWO DOLLARS A MONTH MAKE THE PRESIDENTE'S FAMILY PLUTOCRATS

The old headman of a Negrito village on Casiguran Bay receives a salary of 48 pesos a year for keeping his people under control. With such riches at her command, his wife is the best-dressed woman in the neighborhood. The couple's son acts as chief of staff.

tered the ship in much the same manner as did the locusts, only a little more solidly. On landing at the field we found one monster bat embedded in the shutters of our radiator, with his wings folded around the edges of it. His wingspread was nearly four feet.

NEGRITOS FLOCK TO SEE "BIG WHITE BIRD"

We spent about two weeks at the Aparri base, completing the territory we had planned to map on the northern end of the unexplored strip, then returned to Manila for a new amphibian plane more suitable for the work, and safer. It had just arrived from the United States on the transport *Grant,* and was a Loening amphibian of the type flown by the Hon. F. Trubee Davison, Assistant Secretary of War, and Maj. Gen. James E. Fechet, Chief of Air Corps, to France Field, in the Canal Zone.

Starting out again one morning, heavily loaded, with two seaplanes from Corregidor as escorts, we made the 200 miles northeast from Manila to Casiguran Bay, on the southern edge of the unexplored area, in short order. Now we were living on the very edge of the area over which we had flown before, and had a good chance to observe the wild Negrito tribes.

Before starting to work again we made one trip inland on foot to seek prospects for a landing field up near the lava beds that surround the course of a river emptying into the sea. We gained some idea of what a forced landing would mean in this region.

In Casiguran Bay, we were tied up to the *Fathomer,* U. S. Coast and Geodetic

Photograph by Raymond Stockwell

THRONGS OF CURIOUS NATIVES WERE ATTRACTED TO SAN JOSÉ FLYING FIELD

Living in the dense forests of Mindoro, the Mangyans have had virtually no contact with white civilization. Their swiftest way of sending news from village to village is by beating on tree trunks, and naturally the space-devouring airplane proved a wonder of wonders to them. In many of the settlements both men and women go nearly naked, save for the gee string. The author's feminine visitors on this occasion are wearing far more than the traditional tribal costume.

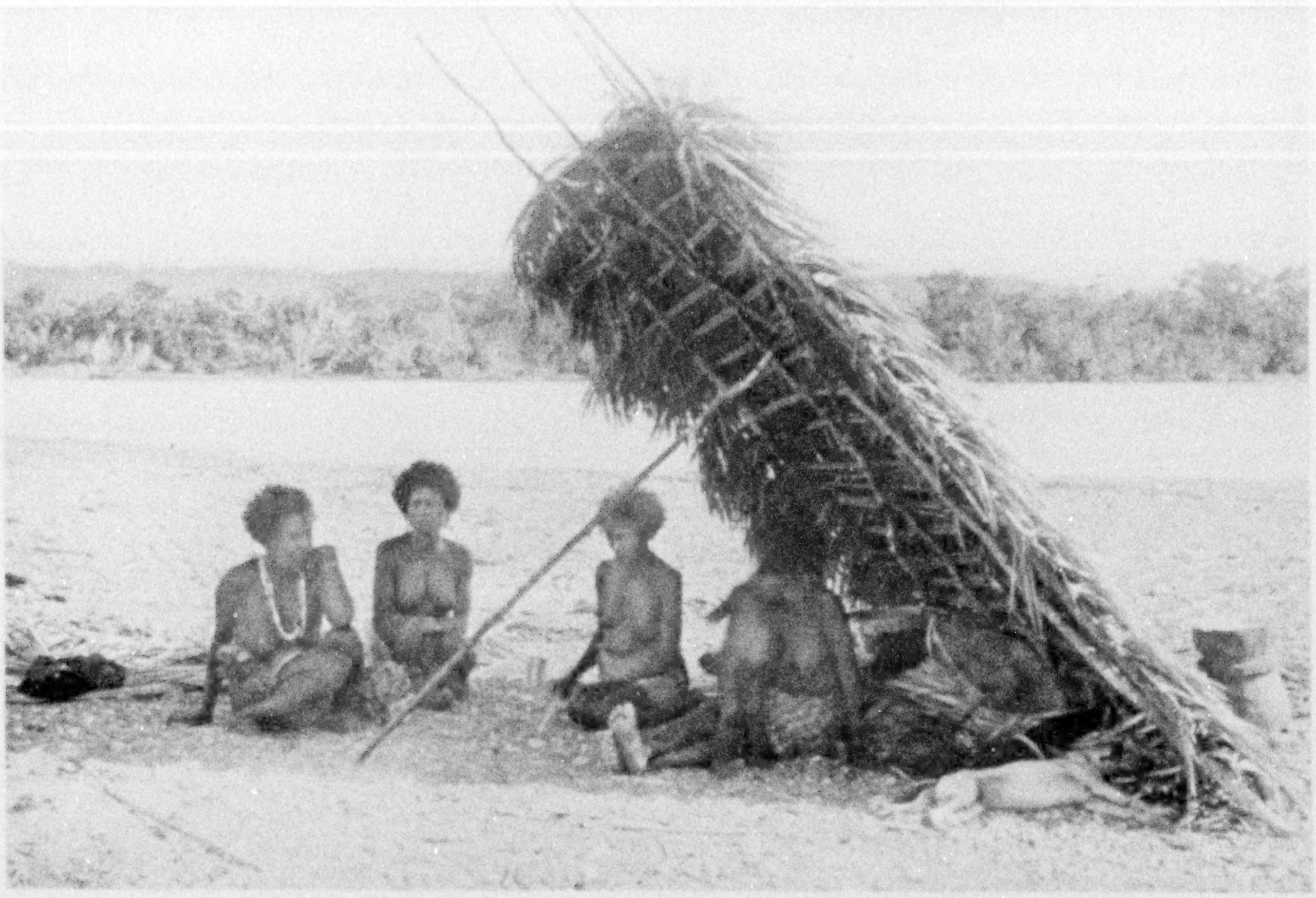
Survey boat, which had been dispatched to this point with our gasoline and supplies. Wells and I, with Capt. G. C. Jones, of the *Fathomer*, made the trip inland, flying up the coast to the nearest approach and taxiing up onto the beach. The point we had sighted appeared to be only a short distance away, but it took an hour or more of extremely hard work to get there. We had to cut our way through tough, thick cogon grass, and had to climb trees frequently to get our direction. We saw many deer and wild pigs, but found no place that would make a decent landing field.

One of the most interesting features of the expedition was our relations with the Negrito visitors, who swarmed about the planes whenever we taxied ashore. They were frightened at first, remaining in the background behind trees and bamboo groves. But they soon discovered that the "big white bird" was not harmful, and they made the most of our visit.

THE BIGGEST EVENT OF A GENERATION

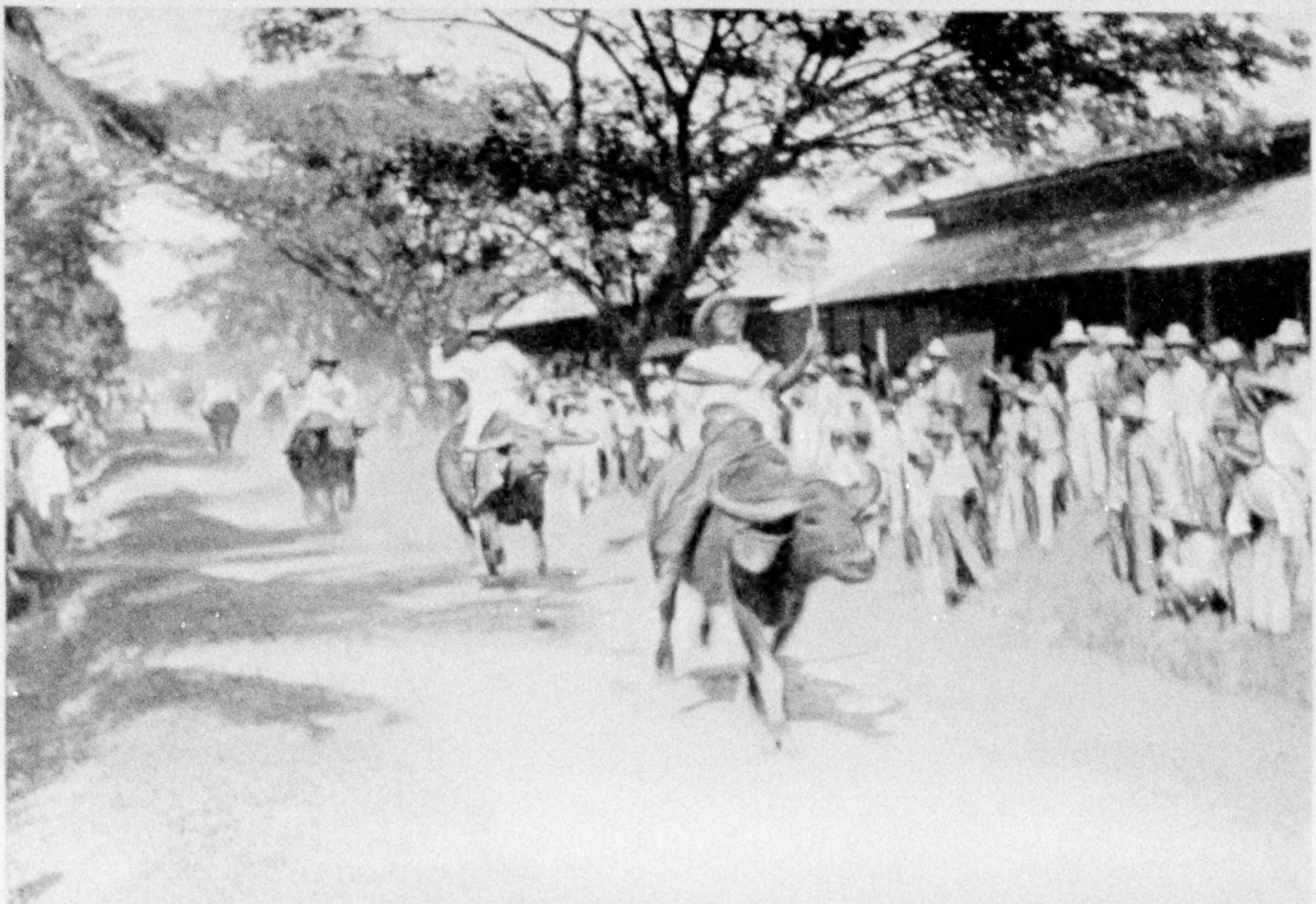
It was just like a "world's fair" to them, the biggest event of a generation. They came from miles and miles around, bringing offerings of bananas, coconuts, lemons, and papayas. In exchange, we gave them empty five-gallon gasoline cans, which they use for water cans, and no offering could have pleased them more. They hugged those cans, carried them around for days, slept with them. We could have had in exchange anything we could carry back.

The *presidente,* a wizened old fellow with sharp eyes, and his wife and daughter were our most distinguished hosts. The presidente receives four pesos, or $2



VENTILATION PRESENTS NO PROBLEM IN NEGRITO ARCHITECTURE

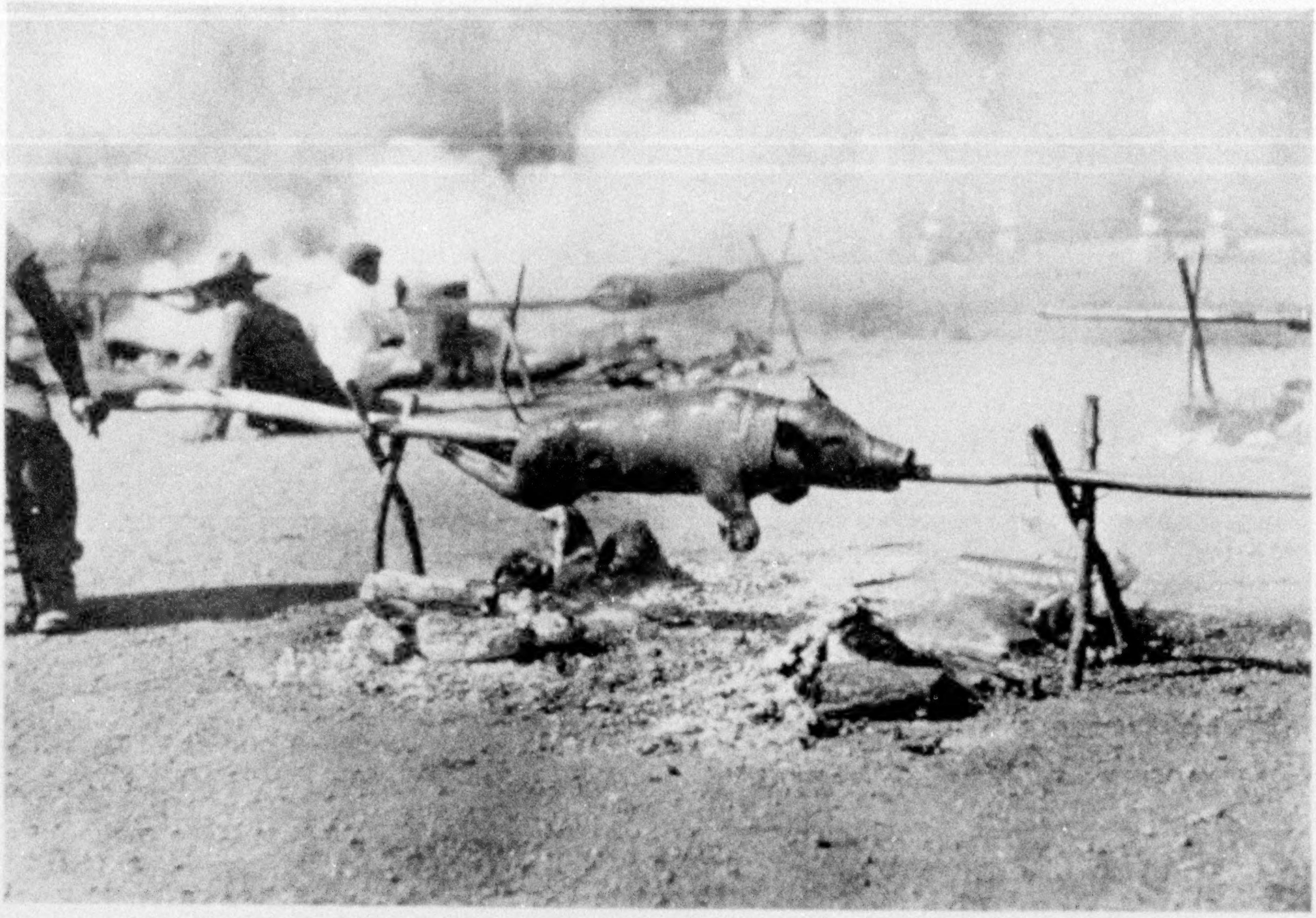
A lean-to, six by eight feet, the size depending on the number, suffices to protect the family from sun and wind (see text, page 314).



Photograph by Merle Le Voy

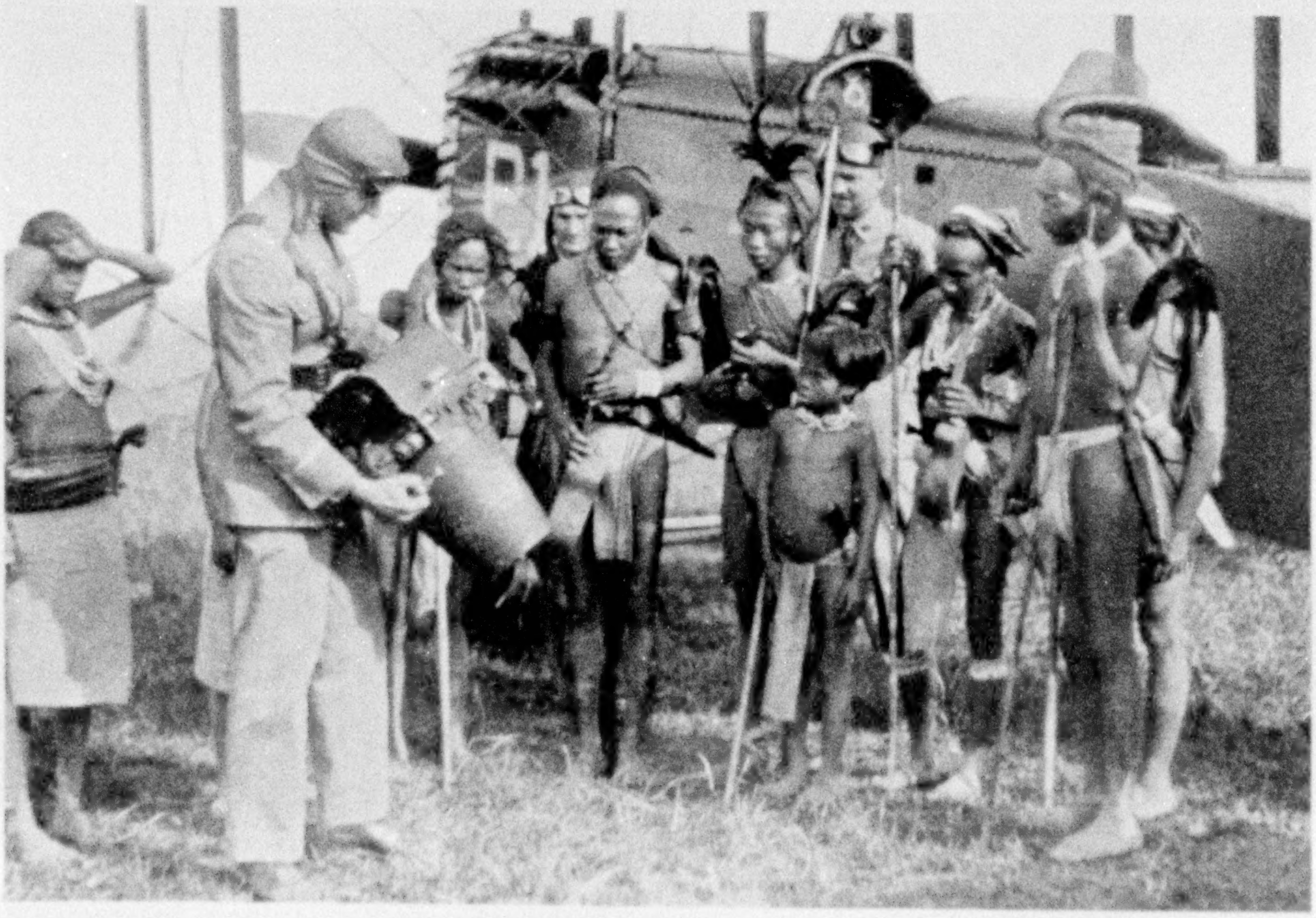
THOUGH SLOW, THE CARABAO RACE OFFERS A THRILLING FINISH

After all, it is the contest rather than mere speed that delights the crowd. Natives at San José, watching these evenly matched water buffaloes lumber down the stretch to the frantic urging of their owner riders, are as much excited as partisan spectators at the Derby.



BARBECUED WILD PIG REWARDS THE HUNTSMEN

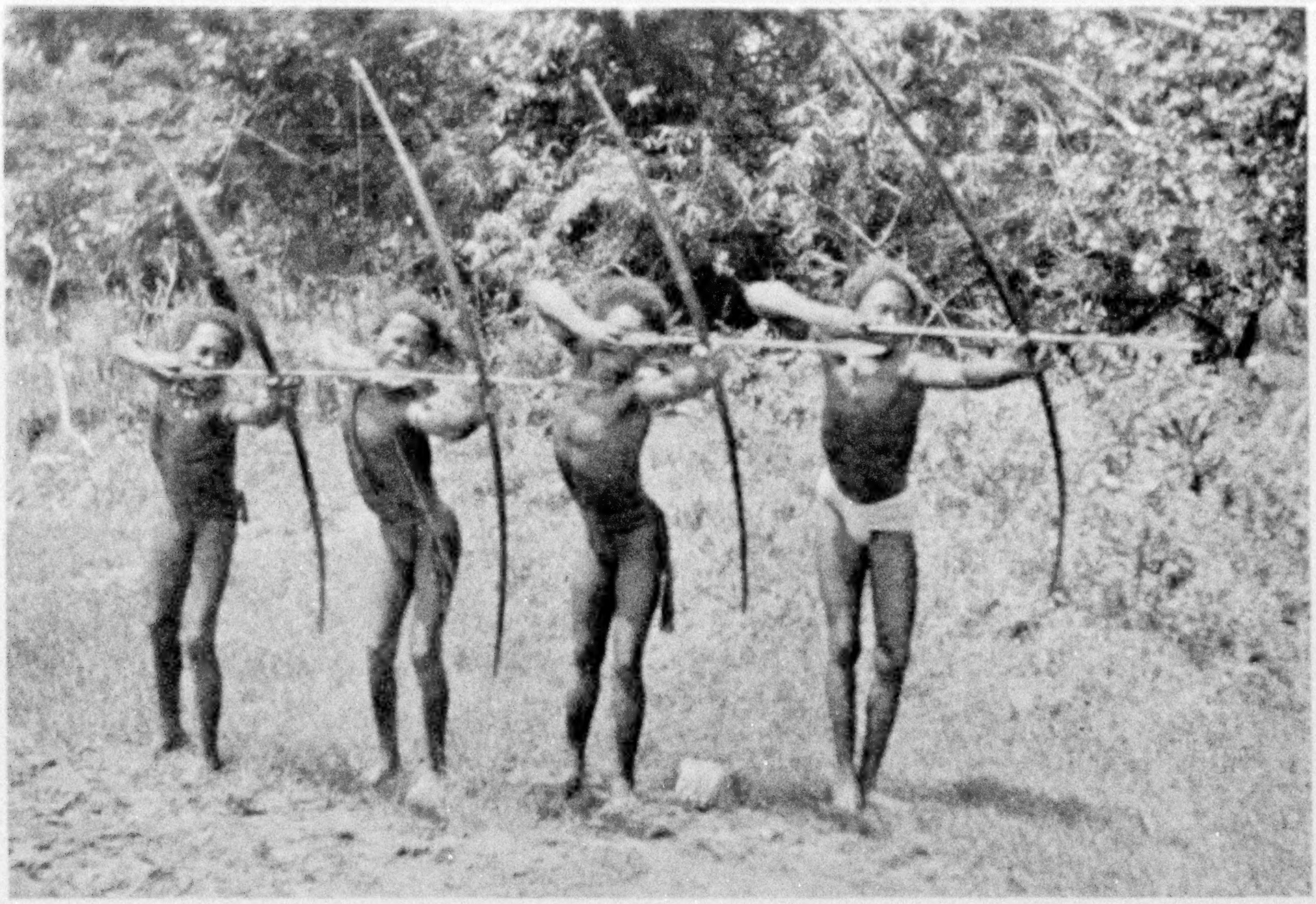
The evening after an exciting chase is a festive occasion at Casiguran Bay.



Photograph by Merle Le Voy

WONDERS OF MODERN SCIENCE SEEM SUPERNATURAL TO THE MANGYANS

On being shown the air camera by the author, a group of primitive hill people gazed at the device in awe. Their own civilization is so backward that they have no weapons save bows and arrows, and indicate numbers above three by tying knots in strips of rattan. It is said that a few of them can count as high as 20 by using toes and fingers.



Photograph by Raymond Stockwell

NEGRITOS, YOUNG AND OLD, ARE SHARPSHOOTERS WITH BOW AND ARROW

While at Casiguran Bay, the flyers were entertained by a remarkable exhibition of native marksmanship (see text below).

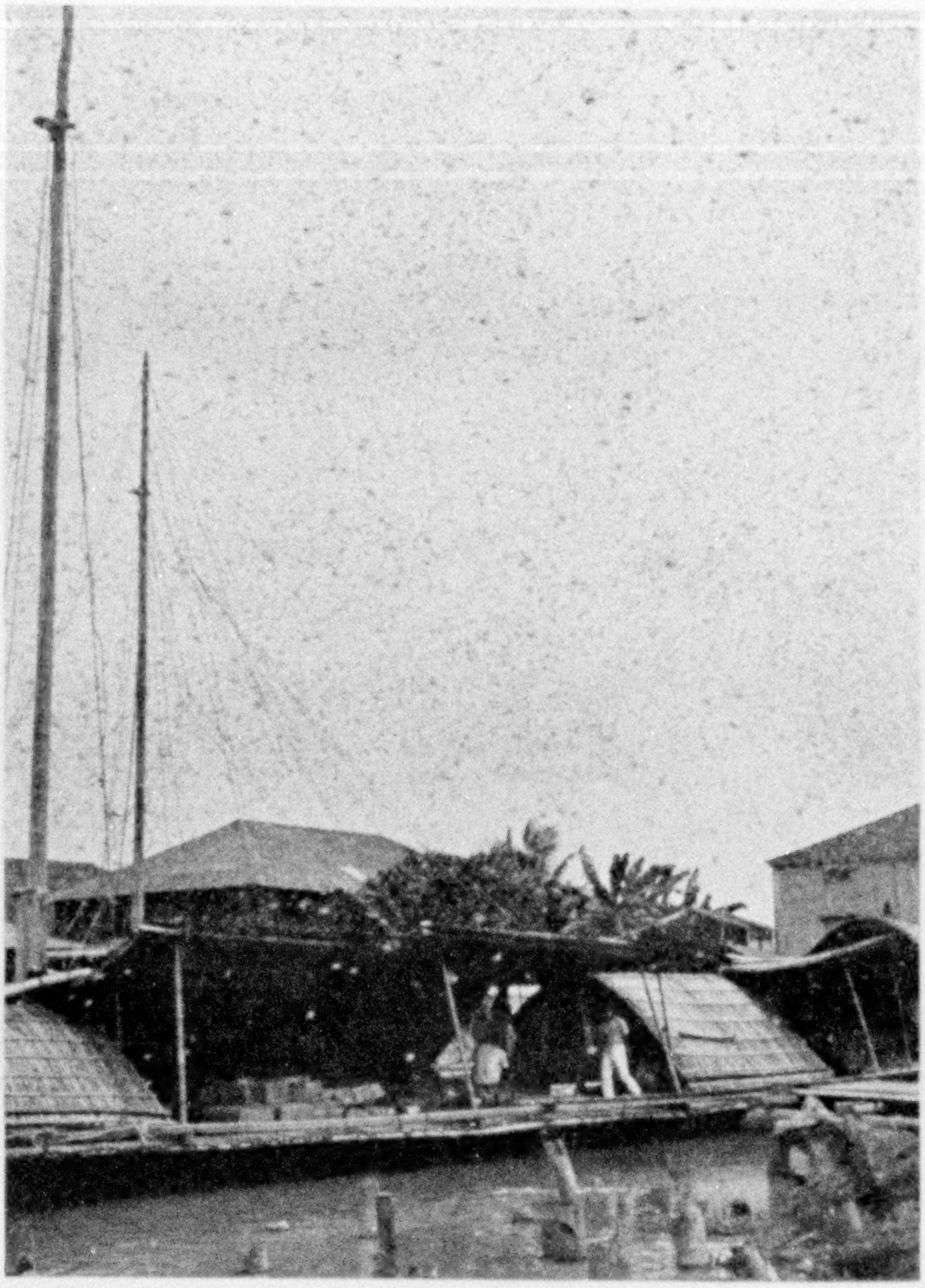
in gold, per month from the Philippine Government for keeping his tribe in order, and is rich beyond the comprehension of his subjects. But our empty gasoline tins started a new vogue in tropical currency. Madame Presidente put most of her husband's salary on her back, judging from appearances. She was the best-dressed woman of all the tribe. But she could no more resist the tremendous appeal of an empty gasoline tin than could the most lowly tribesman. She carried hers around with her for three days, and slept with it, like the rest.

The largest Negrito village in the region was on the south edge of the area we were working, not far from where the Coast Survey cutter lay. We landed there for a visit, but could not taxi up on the beach. The sand was too soft. The natives came out and carried us ashore on their shoulders, and stayed to talk for hours. We traded oil tins for bows and arrows and other trinkets. When it was time to leave, half the village waded out to the plane and put their shoulders under it to get it back in the water. We flew around them and performed some stunts to repay them for helping us off the sandbar.

A CLEAN, FRIENDLY PEOPLE

These natives, a clean, friendly people, practice modes of self-decoration that are typical of South Sea islanders. They cut designs on their bodies in childhood, using for the purpose pieces of broken bottles or sharp shells and rubbing dirt in the wounds to make them fester and leave welts. They slit their ears, especially the women, and leave the lobes hanging to their shoulders, stuffed with cigarettes, perfumery, and other objects they want to carry around with them. They chew betel nut, and usually carry the paraphernalia in the ears. Instead of filing their teeth down to sharp points as many wild people do, they file them flush with the gums, so that they look like a toothless race; but some of the younger members have fine sets of white teeth.

Young and old are expert with the bow and arrow. At one village we were entertained with a remarkable exhibition of



Photograph by Merle Le Voy

FLIGHTS OF LOCUSTS SOMETIMES DIM THE SKY AT APARRI

To the flyer attempting to make a landing such clouds of insects present a dangerous hazard (see text, page 327).

prowess. Coconuts were placed on a pole, as a target, and the marksmen split them with amazing frequency. A few blowguns with poisoned arrows are used for hunting and for tribal warfare, but these Negritos are generally peaceful.

They were crazy to fly. As white men, we ourselves were objects of curiosity, but the planes came in for special tribal adulation and wonder. Whenever they could get our attention they tapped themselves on the chest and pointed to the sky with a beseeching look.

I am sure they attached some supernatural significance to the "big white bird." They never discarded the notion that the plane was a species of fowl. Some of the crew on the Survey boat, who have been charting the coast for years, understood enough of their language to learn that the natives had decided that the wheels, which drew up under the pontoons, were birds' claws. One old fellow spent hours squatting in front of the plane, trying to make his arms go around like the propeller. If he could once get the hang of it, perhaps he might fly by himself!

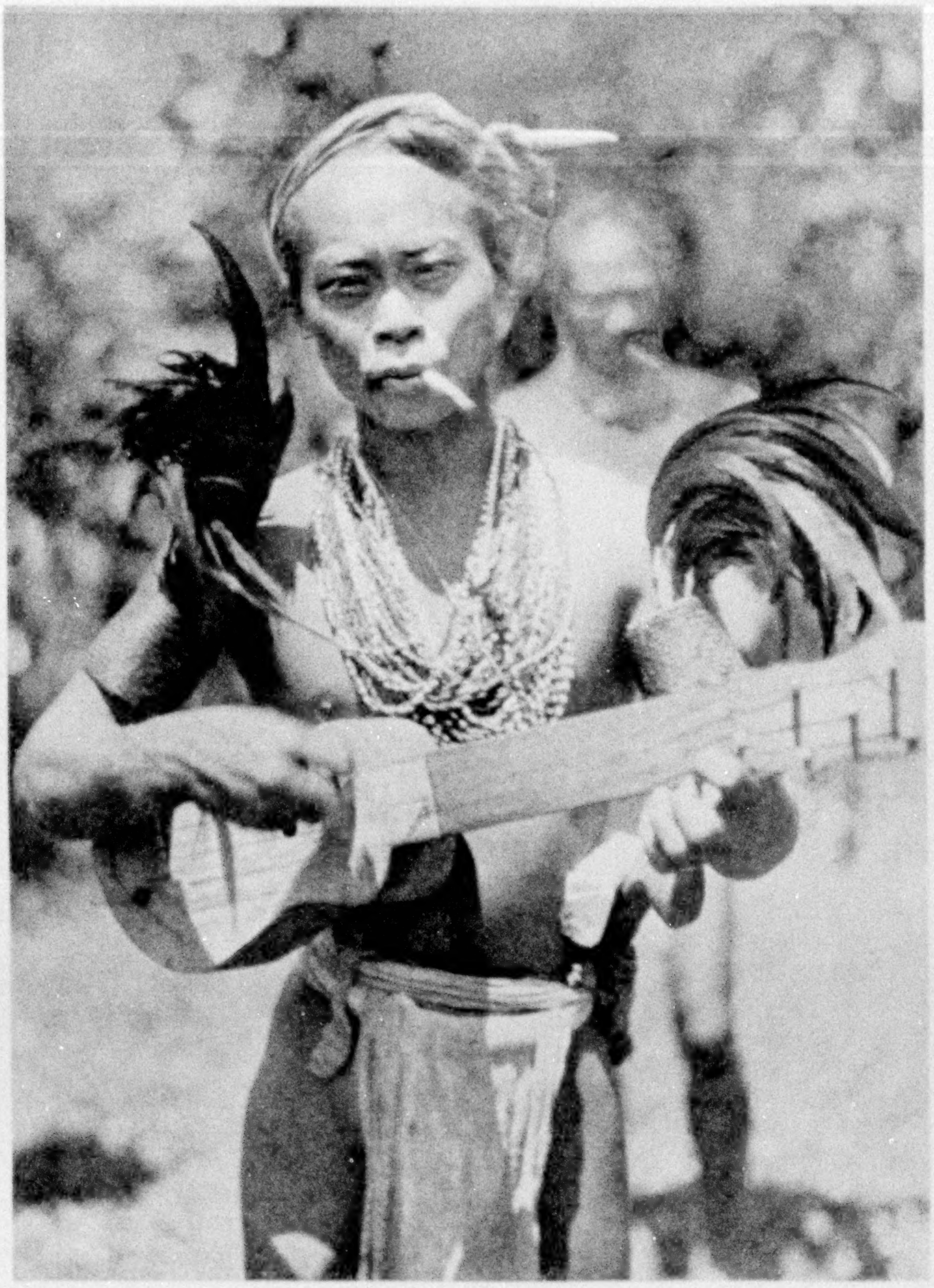
The plane was undoubtedly "good medicine." All who could crowd close enough to it touched and fondled the wing surfaces and fuselage. Becoming bolder, they climbed all over it and into it. At night they went to sleep on the sands close by, with oil cans for pillows.

AMERICANS SEEM ALL-POWERFUL

The presidente wanted to know how big the stars and the moon looked when we went up in the plane at night. I have had Americans living in our own country ask me the same thing.

A very amusing incident happened one evening when, unannounced, we ignited a piece of an obsolete airplane flare which produced about 500,000 candlepower. The light, which was located at the edge of their settlement, gave the natives quite a scare and practically all of them took off for the mountains. We learned later that they thought their god, which is the moon, had fallen to the earth and was about to punish them.

The next morning runners carried the news that the "Americano" had caused the light and that everything was all right.



Photograph by Merle Le Voy

HUMAN HAIR SERVES AS STRINGS ON THE MANGYAN UKULELE

Remarkable natural musicians, the people of this tribe of the forested interior of the island of Mindoro sing to the accompaniment of homemade stringed instruments and bamboo flutes. Their "ear for a tune" is so keen that they can reproduce clearly a melody after hearing it but once.

They immediately returned and requested that we repeat the spectacle, which we did a few nights later, for their amusement and for motion pictures of their dances. To them, it would seem, the Americano can do anything. They have seen his cigarette lighters, cameras, field glasses, airplanes, have undergone slight operations and been cured by medicine, and so our light business was not so puzzling after all.

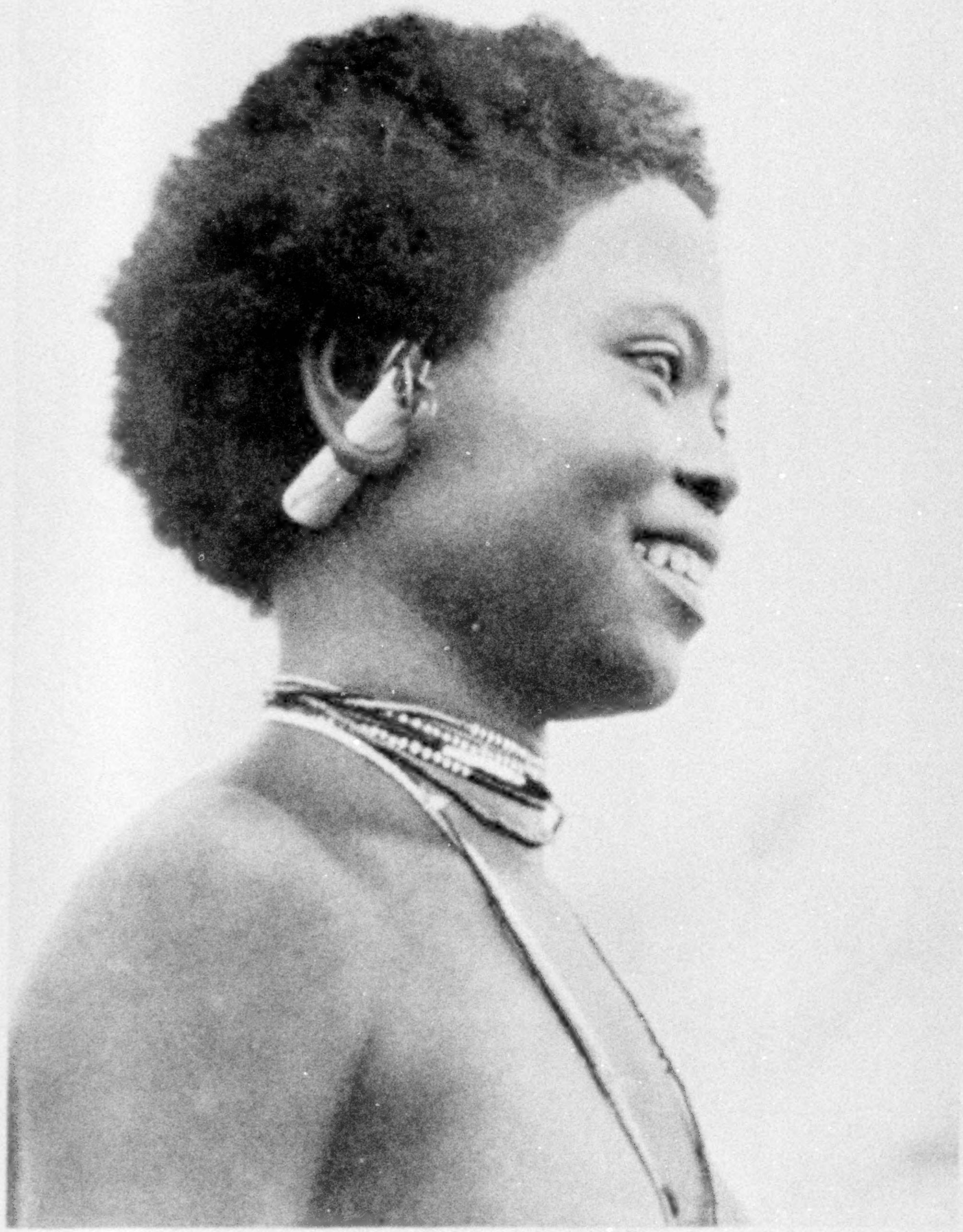
We had some sardines, some rice, and a bag of salt that proved very welcome gifts, and some red cloth which we brought along pleased the presidente's daughter beyond words. She allowed us to dress her up in it, and we made her look as much like an American "flapper" as possible. The women hereabout use the sweetest perfume in the world, a kind of herb which they find in the forest, crush and place in the split lobes of their ears, inside cylinders of rolled cloth (see illustration, page 336).

Our work on the southern edge of our territory was about the same as from the Aparri base. We spent the morning in flying and mapping, and were tired out at the end of four or five hours. The sudden climb from tropical heat to the frigid upper air is debilitating.

SUITS OF SPONGE RUBBER WORN

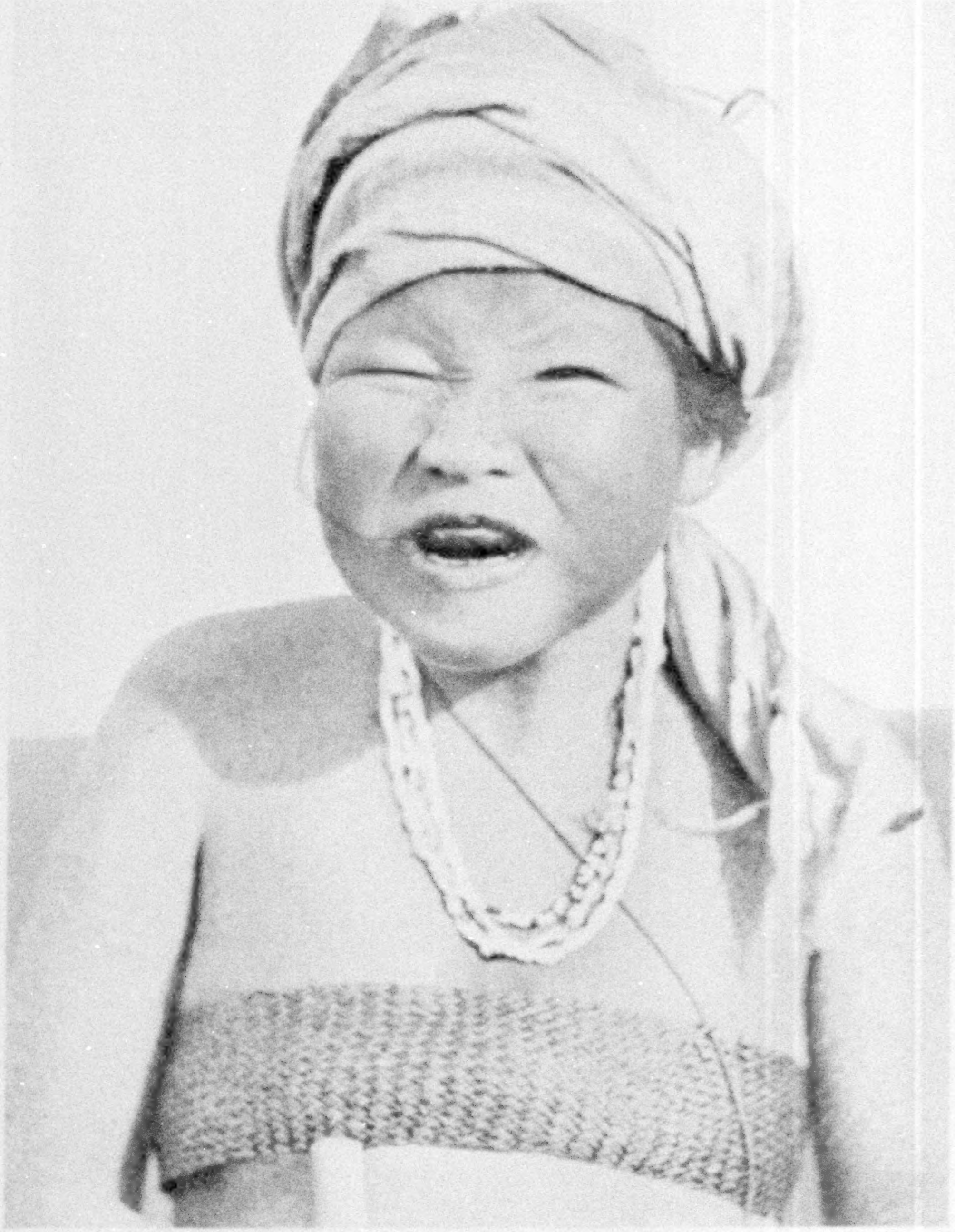
We wore suits of sponge rubber which were unbearably hot on the ground, but we needed all the protection we could get from the cold at the 12,000-foot level. Everything, including ourselves, sweated copiously on the descent. The camera equipment in the planes got as wet as if we had been parked out in a rainstorm. It was a problem to keep the film dry under these conditions.

Flying close over the forests, the noise of our motors would arouse thousands of birds and animals. Monkeys abound, and their chatter is added to the cries of birds and the noise of insects. With more altitude, the trees, which average about 100 feet in height, take on the aspect of a vast green cauliflower, so close together are they.



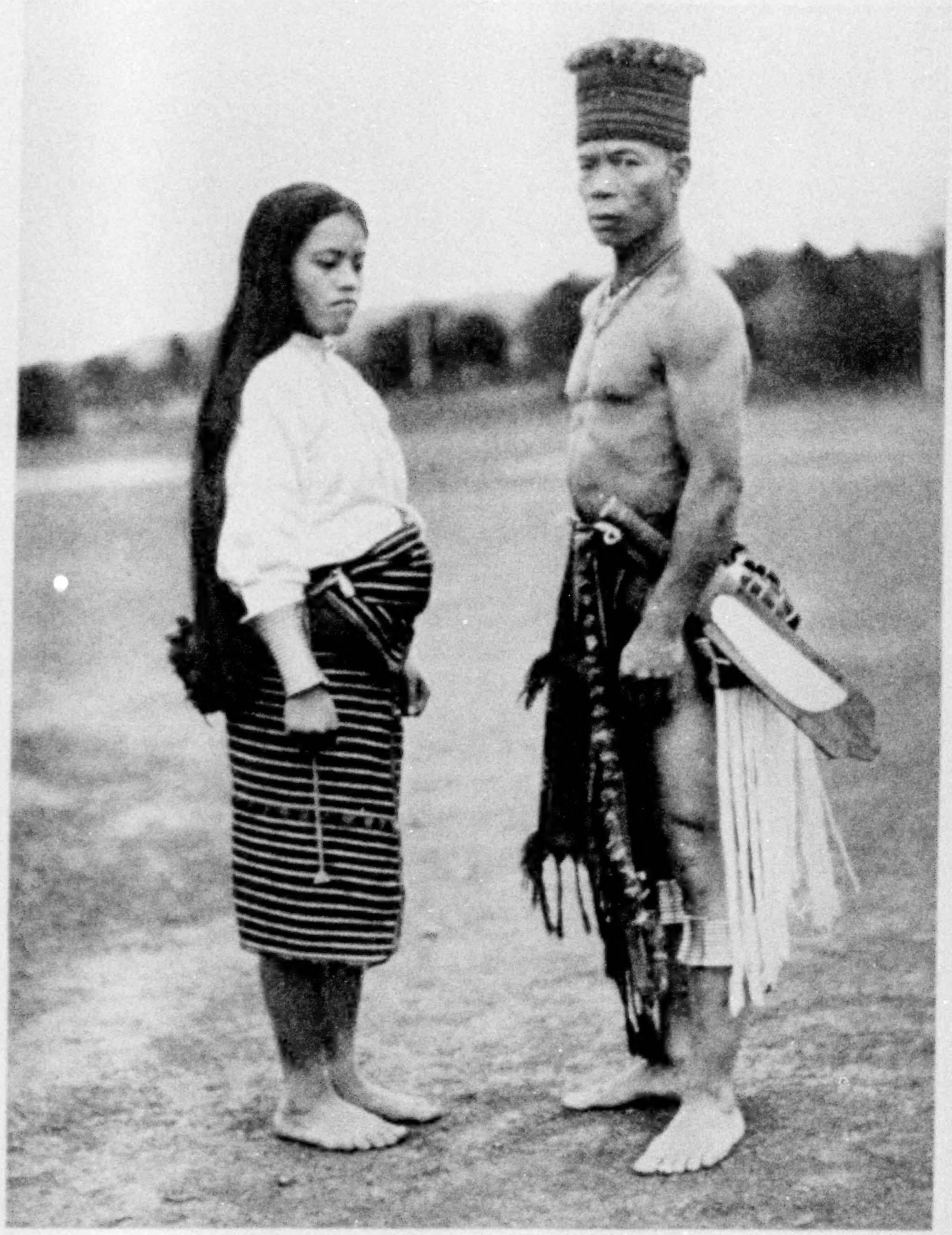
SHE CARRIES HER PERFUME IN HER EAR

A Negrito girl of Casiguran Bay gives a demonstration of the use to which a perforated ear lobe can be put in the Philippines. The powerful essence to which she is especially partial is made from a crushed forest herb (see text, page 335).



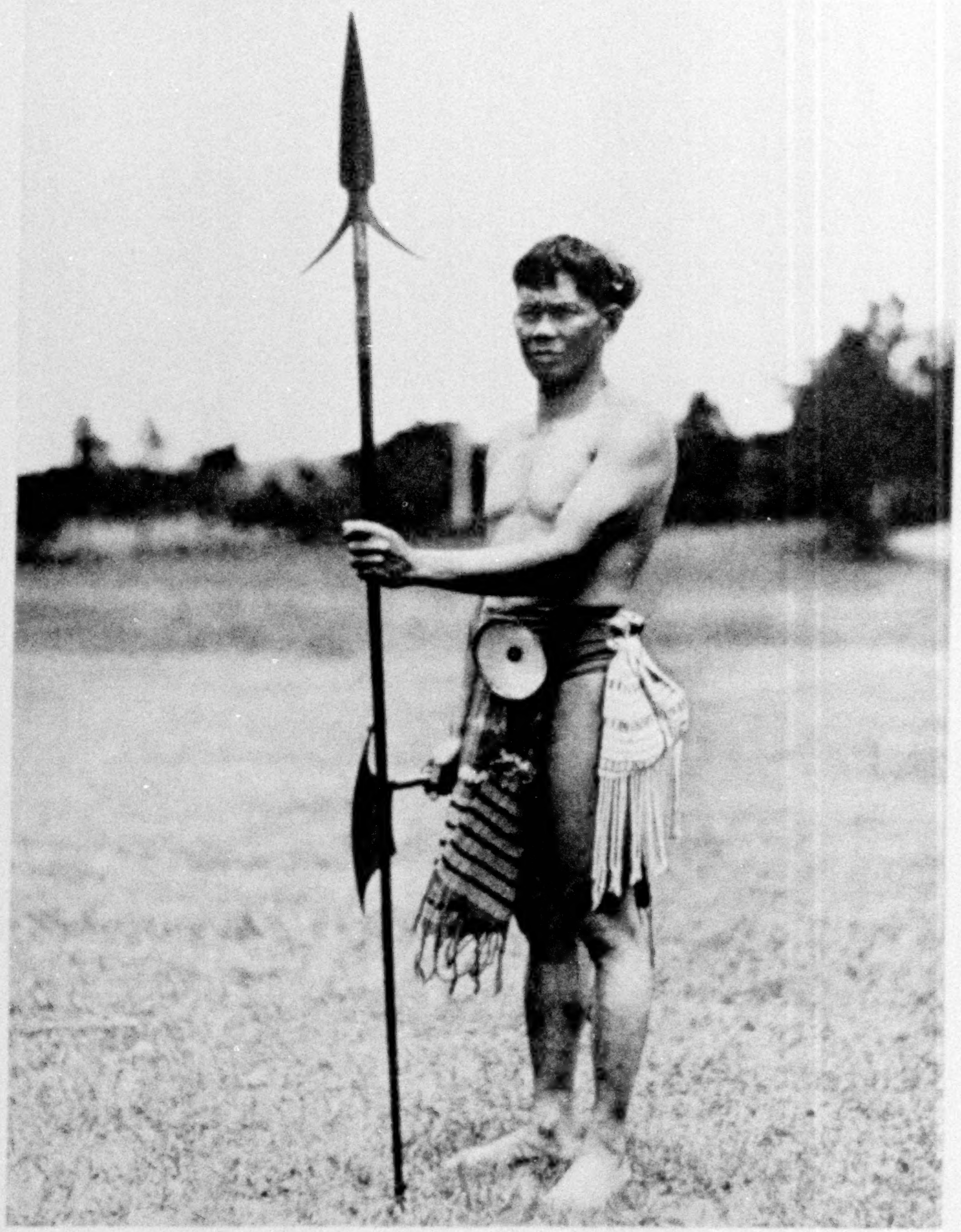
STYLES CAUSE THE MANGYAN WOMAN NO ANXIETY

Her attire is simple; a cloth turban, a woven bandeau, a short skirt, and a few beads suffice. In outlying villages the costume often consists of nothing more than a gee string. Both men and women of her tribe wear their hair long and file their teeth to the gums.



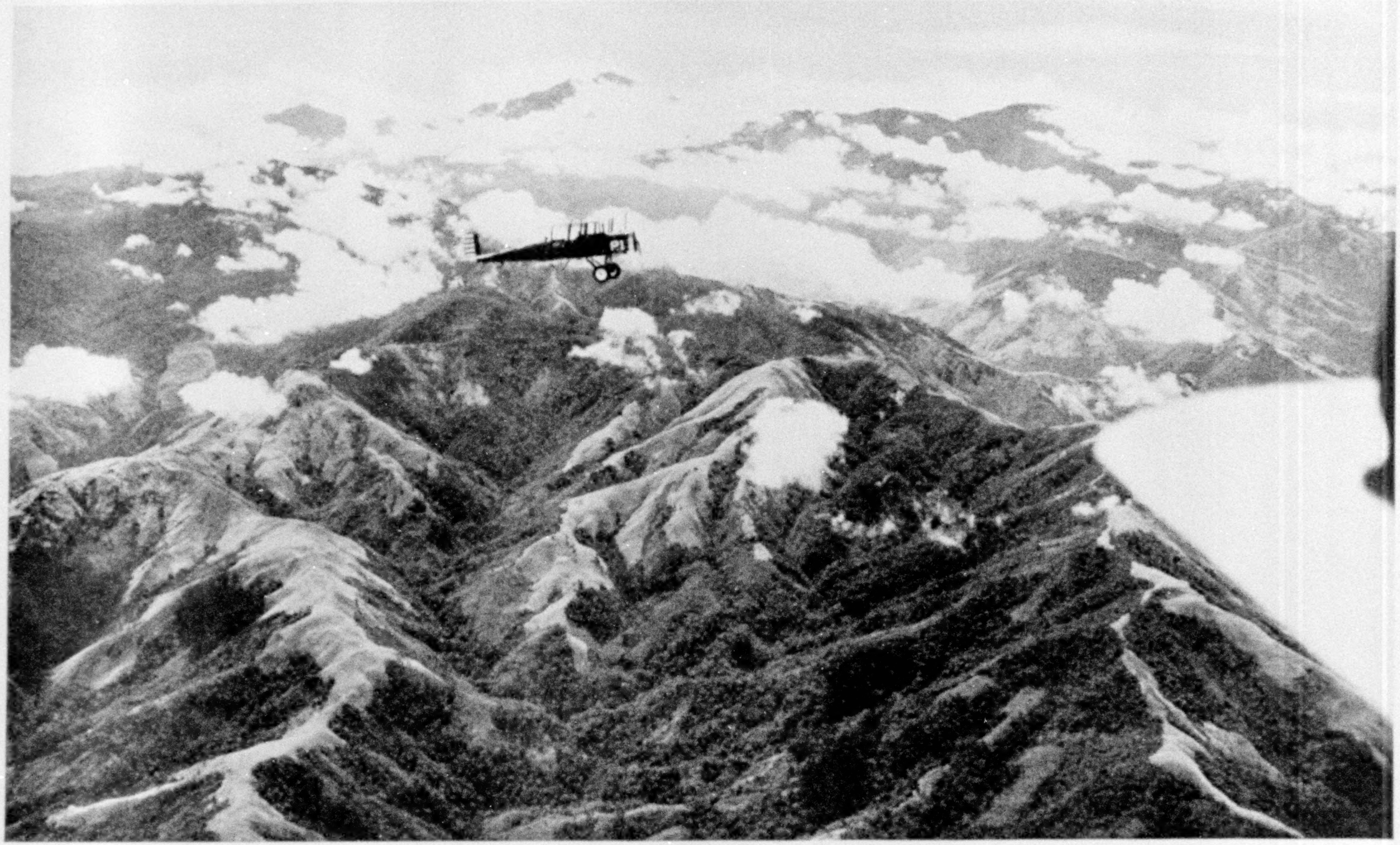
IFUGAOS HAVE DEVELOPED AN EXCEPTIONAL CULTURE

These pagan tribesmen, builders of most of the mountain rice terraces, are distinguished for extraordinary industry (see illustration, page 322). They have a 13-month calendar, kept by the clan wise man, who begins his reckoning about mid-July by tying a knot in a string. For every succeeding day a knot is made until the number totals 28. A new cord is then started for the next month.



ONCE THE HEAD AX AND SPEAR HAD DEADLY SIGNIFICANCE

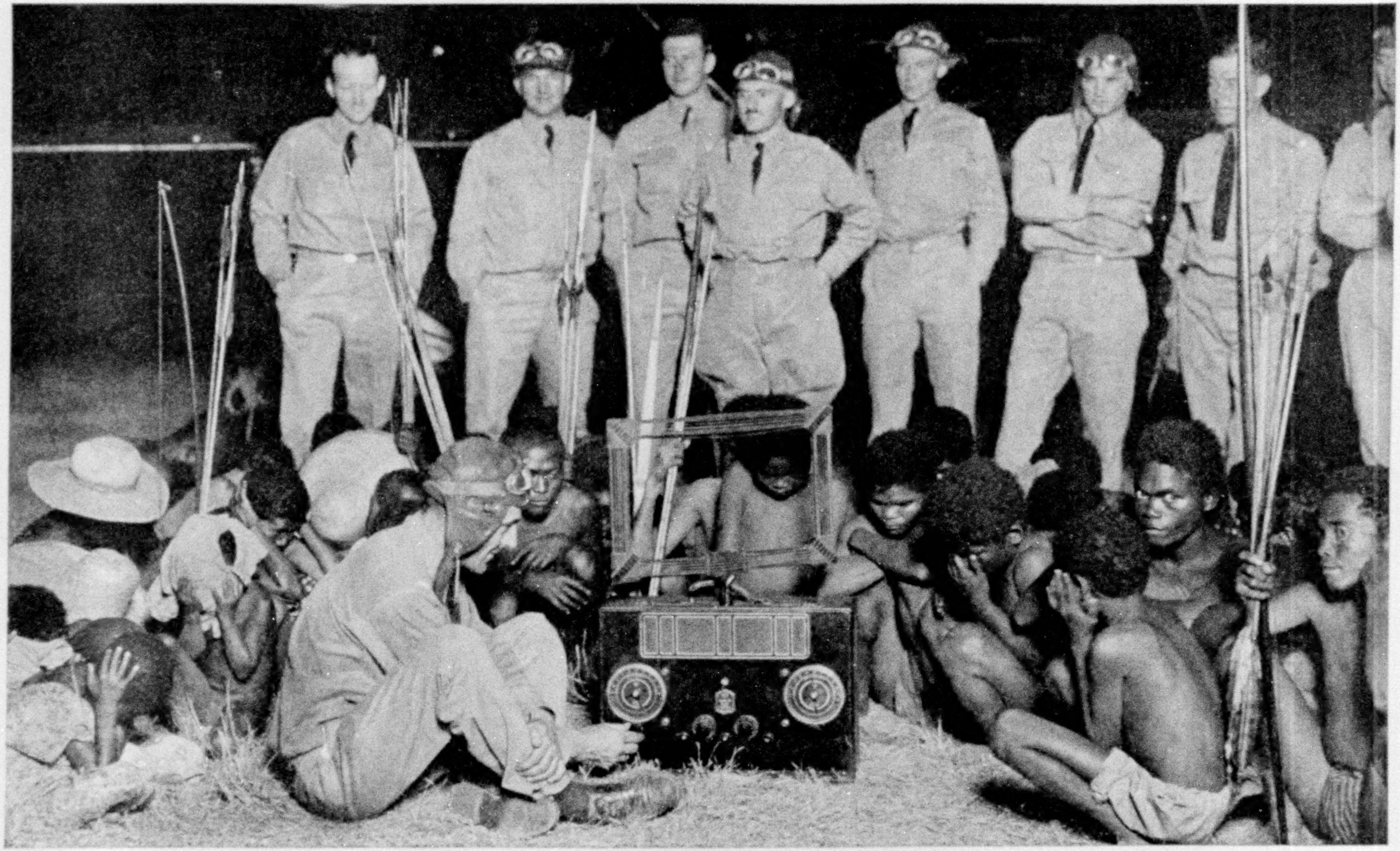
Pagans of northern Luzon are referred to in the census of 1903 as *Igorots*, but the term means merely *mountain people*, and is not the name of a tribe. Groups included in the classification are the Bontocs, Kankanai, and Nabaloi. This man is equipped with the weapons that played a gruesome part in the feuds between the clans before American occupation.



Photograph from Lieut. G. W. Goddard

MANY FLIGHTS WERE MADE OVER AREAS NEVER BEFORE SEEN BY WHITE MEN

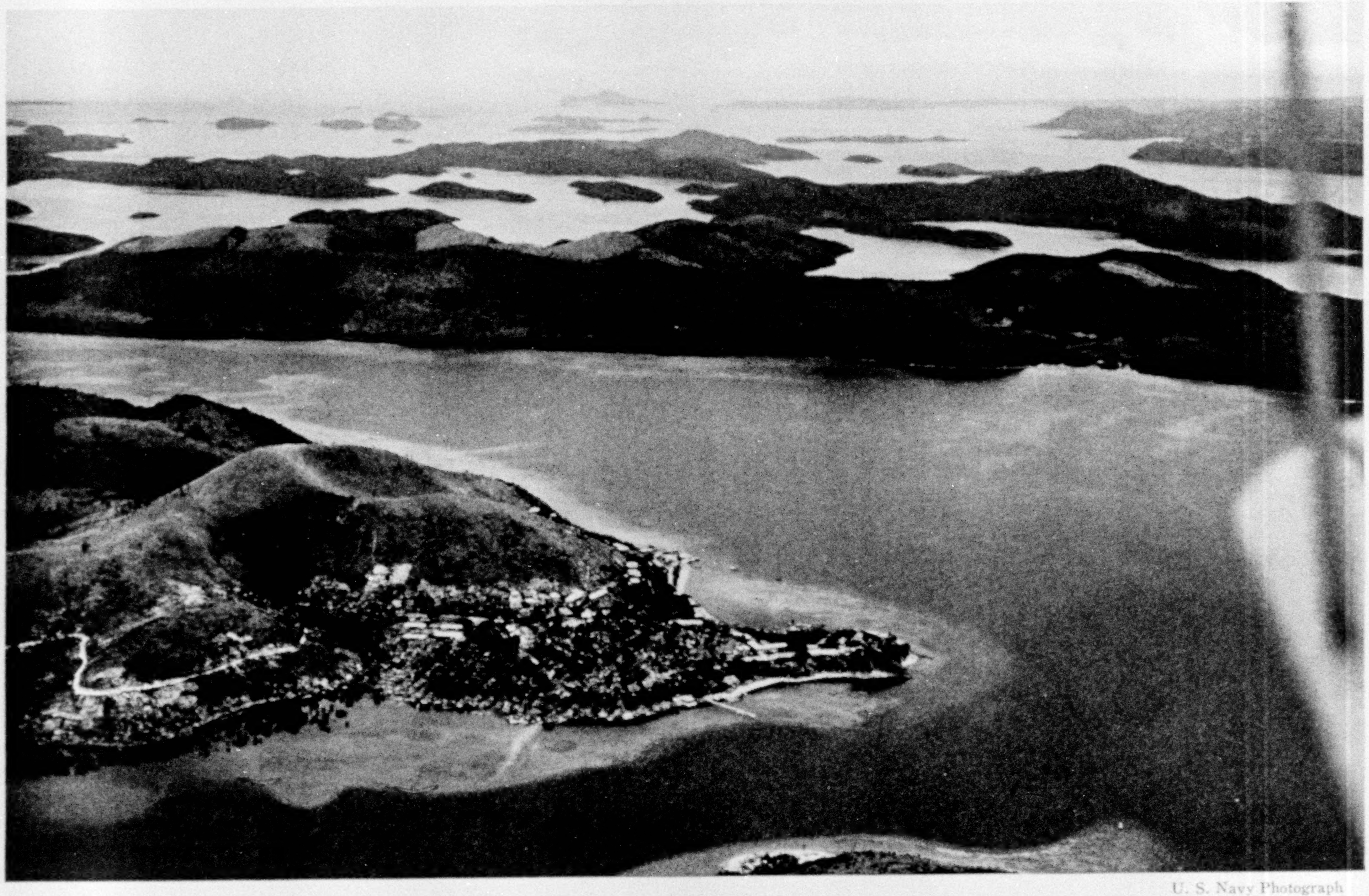
In northeastern Luzon lie mountain fastnesses which, until the coming of the mapping expedition, were among the earth's blind spots (see text, page 311). Grass covers these rugged peaks above the timberline. The plane in the background is that piloted by Lieutenant Wells, "the Deacon."



Photograph by Raymond Stockwell

FROM NOWHERE COMES A VOICE THAT TERRIFIES THE SIMPLE NATIVES

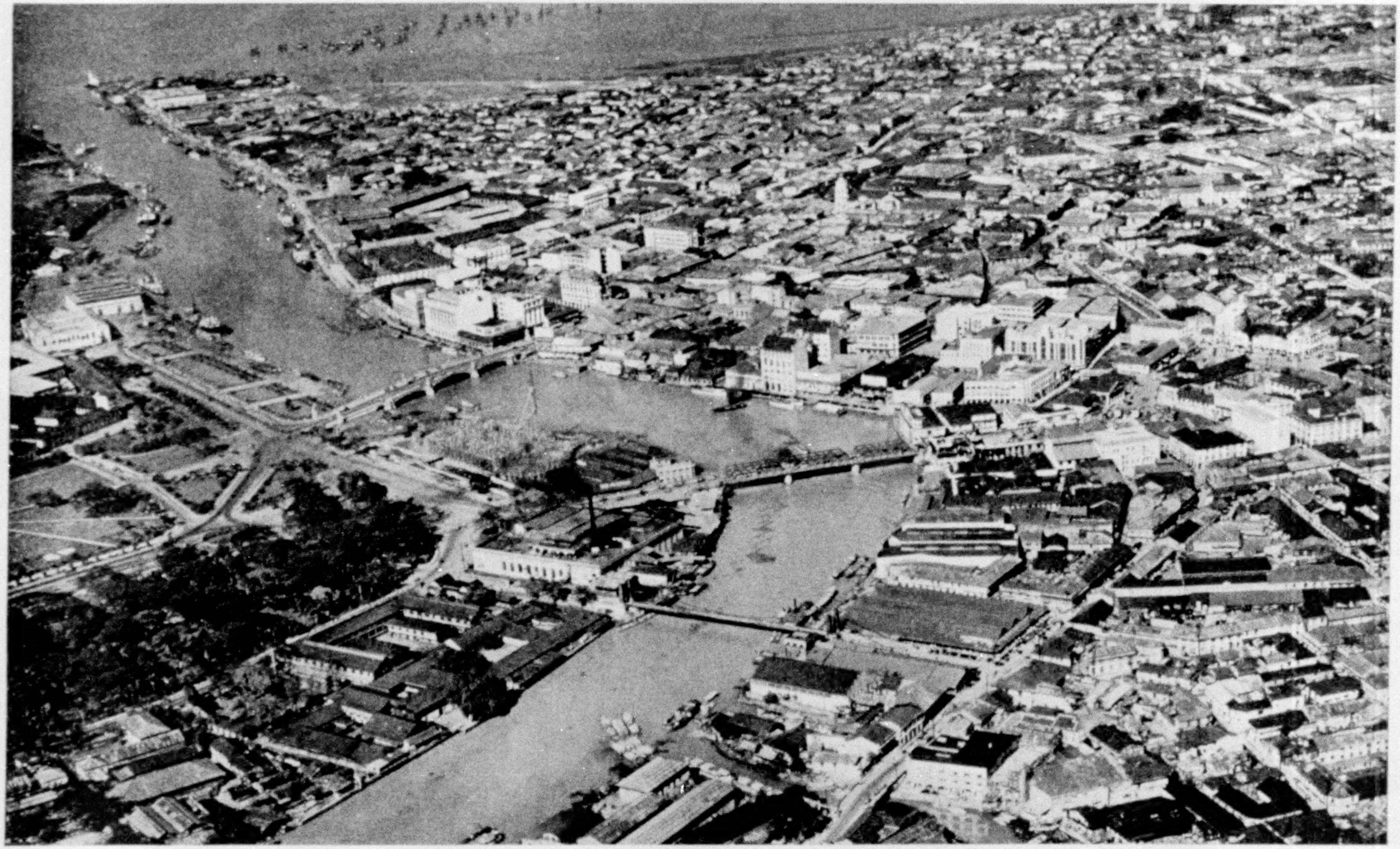
Tuning in on Manila for the Negritos' first radio concert, the author produces an effect on his audience that combines pleasure, fear, and fascination, registered by clasped ears and covered faces.



U. S. Navy Photograph

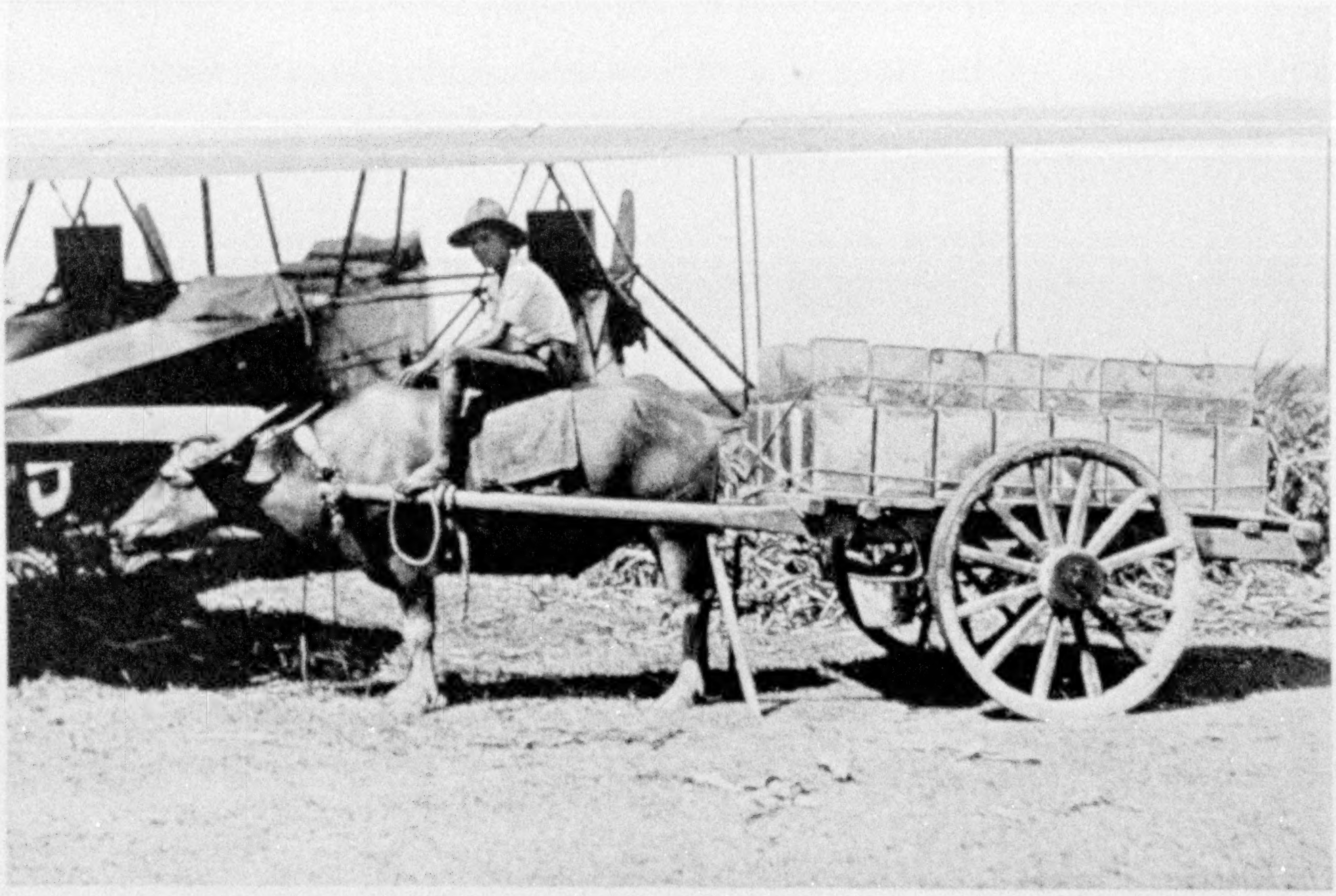
A FEW OF THE 7,000 ISLANDS OF THE PHILIPPINE ARCHIPELAGO SEEN FROM THE AIR

This view, near Bilaa Point on the north coast of Mindanao, is characteristic of the Far East insular possession of the United States. Mindanao, in the southern half of the archipelago, is second in size to Luzon, having an area about equal to the State of Indiana.



MODERN MANILA, FROM AN ELEVATION OF 3,000 FEET

On the banks of the Pasig River, in the left foreground, is the Sternberg Hospital, adjacent to the City Ice Plant (with the tall smokestack). The new Post Office, under construction, on the same side of the river, is seen in the middle distance. The second bridge is the Santa Ana, with the handsome new Jones Bridge further downstream. On the left bank, near the bay, is the U. S. Army headquarters of the commanding general; offshore, to its right, is a Japanese fishing fleet.



Photograph by Merle Le Voy

FUEL FOR MODERN TRANSPORTATION COMES BY PRIMITIVE MEANS

It is a far cry from the cart drawn by the water buffalo to the great plane that sweeps through the heavens, yet without the one the other would be helpless in northeastern Luzon.

The waterfall we discovered was a considerable distance inland, on the course of the largest river that crosses the area. It is visible from only one angle, so dense is the growth around it, and it was by accident that we made the discovery. We flew close enough to get some good photographs of it, adding this tangible bit of information to the lore of the untouched Philippines (see page 310).

We were forced one day to land in the swells along the coast when the water jacket in our amphibian sprang a leak, and we had a better idea after that of what it would have meant to try them in a land plane. It took some careful handling to set the plane down in them. When we finally settled, they lifted us 10 to 15 feet in the air at a toss, then let us down in the hollows with a sickening drop.

Just before coming down we had seen a 9- or 10-foot shark close to the surface. This was none too reassuring. Examination revealed that we had enough water in the radiators to get us back to the Survey cutter, so we took off again, taking advantage of a strong wind.

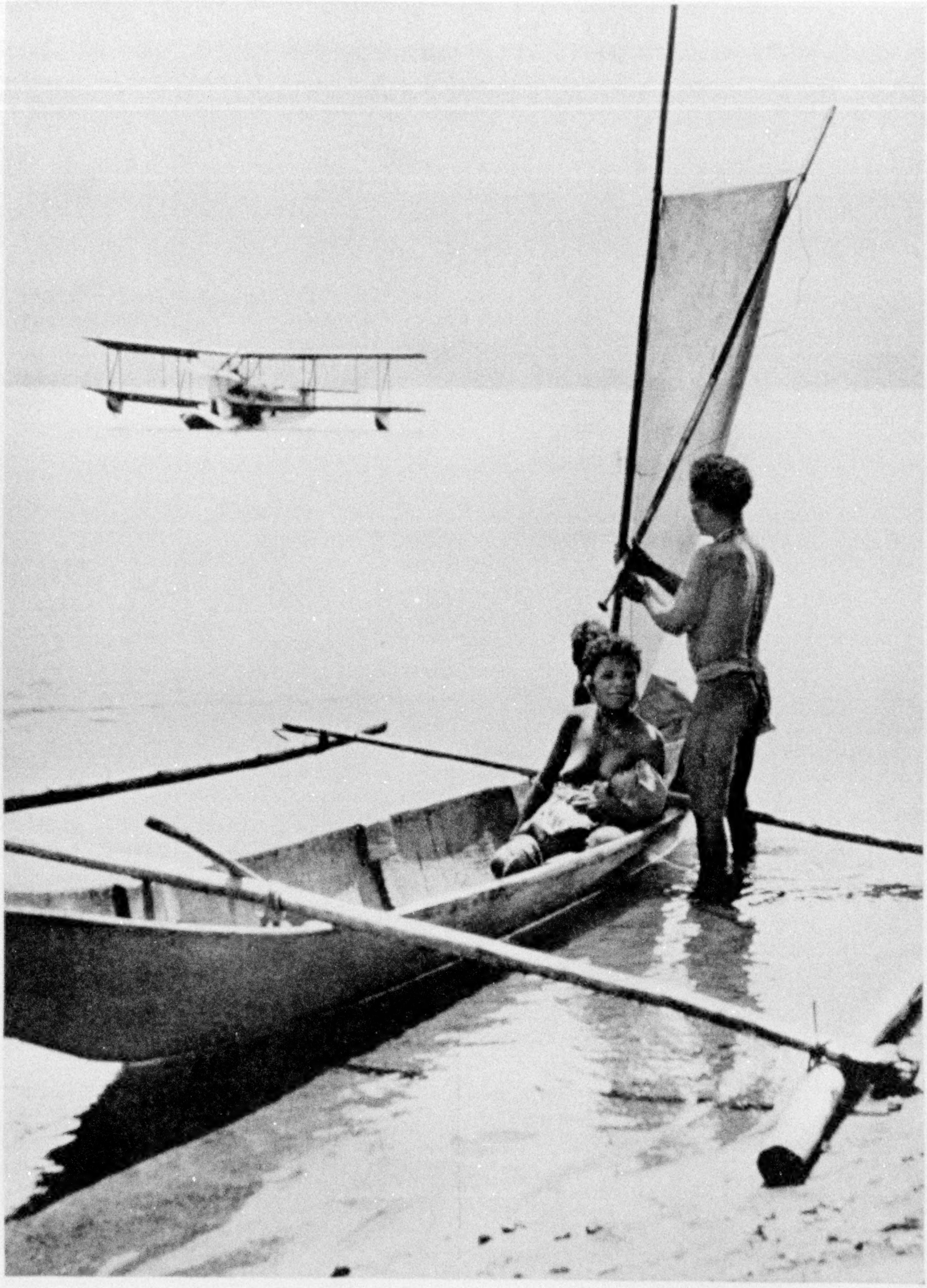
We also had another forced landing on the way down the coast toward home after we had completed the job. One of the escort ships lost a spark plug and descended to install a new one. The Deacon couldn't resist taking a swim, despite the sharks, but when he ran into a five-foot sea turtle he scrambled out in a hurry.

The results of the trip, taken as a whole, were very encouraging from several points of view. Our photographs, taken in one month, covered practically 5,000 square miles and saved the U. S. Coast and Geodetic Survey, the Philippine Forestry Bureau, and Bureau of Lands an enormous amount of time on their preliminary survey work.

These photographs show sufficient detail on which to base valuable Government reports. Even the underwater detail to a depth of 20 feet is shown in certain localities along the coast line.

There is power in the rivers, timber on the surface, rich soil for cultivation, and resources under the soil in the area over which we flew.

Besides all this, our trip proved again that the airplane is invaluable in tropical exploration.



IN CASIGURAN BAY THE AMPHIBIAN HAD PRIMITIVE HARBOR MATES

Centuries of progress separate the natives' outrigger sailing canoe and the modern seaplane, yet the eye of fancy can detect a strange resemblance between them.

UM

THE COLOR CAMERA'S FIRST AËRIAL SUCCESS

By Melville Bell Grosvenor

With Illustrations from Natural-color Photographs by the Author

IT WAS indeed a red-letter day in world progress when, in 1829, the two Frenchmen, Daguerre and Niepce, combined their researches in chemistry and the camera, out of which emerged the daguerreotype. Down the milestones of a hundred years from that day, the brains of unnumbered students of photographic science have labored and traveled to perfect and simplify the need of mankind for faithful imagery, and thus create a language that is to-day more universally understood than any sounds formed by the human voice.

No single man may claim to be the discoverer of photography. It was the outgrowth of theories born of early alchemists and chemists who turned their stumbling steps toward the study of the action of light. Out of such research evolved the science of photochemistry.

The fundamentals of the camera were known as far back as the twelfth century. Even the great inventor and artist, Leonardo da Vinci, who was born in 1452, described and left among his papers the theory of a camera obscura. In 1568 Barbaro suggested convex lenses and a crude diaphragm by which a sharper image might be obtained.

But whereas pioneer experimenters of the Middle Ages groped laboriously forward, recording progress through slow decades and centuries, the modern development and refinement of the camera and the photograph—the stereoscopic camera, the motion picture, the natural-color photograph, the aërial photograph, the microphotograph, the X-ray photograph, the sound picture—have all come within the memory of living men.

COLOR PHOTOGRAPHS FROM EARTH, SEA, AND SKY

Of equal importance and value in the dissemination of knowledge through photographic records has been the contemporary development of photo-engraving, by means of which the details of a photograph may be transferred to the printed page, both in black and white and in color, and thus less expensively multiplied by the million. The educational value of this achievement is priceless.

In pursuing its mission—the increase and diffusion of geographic knowledge—the National Geographic Society, through its official journal, the NATIONAL GEOGRAPHIC MAGAZINE, has made the photographic illustration its handmaiden. For more than 30 years The Magazine's pages have been enriched by the contributions of photographers from all parts of the earth, even from the floor of the sea and, more recently, from the skies above.

Members of The Society will recall that the first natural-color photographs to be made of under-sea life were reproduced in their Magazine,* and that the first series of natural-color photographs of the Arctic regions were also made by The Society's staff photographers for these pages.† Now come the first successful natural-color photographs made from the skies.

NEWLY DEVELOPED PLATE MAKES AËRIAL COLOR PHOTOGRAPHY POSSIBLE

Aërial color photography has perhaps been previously attempted, but heretofore it has been impossible to overcome the primary difficulty, namely, that natural-color plates require from fifty to sixty times the length of exposure to light necessary for black-and-white pictures. With such a time handicap, successful color photographs from swiftly moving airplanes and from wind-tossed lighter-than-air craft have been impossible.

Recently, however, a new method of natural-color photography has been developed abroad, and the National Geographic Society sent Mr. Charles Martin, the chief of its photographic laboratories, to study this and other processes. The new plates

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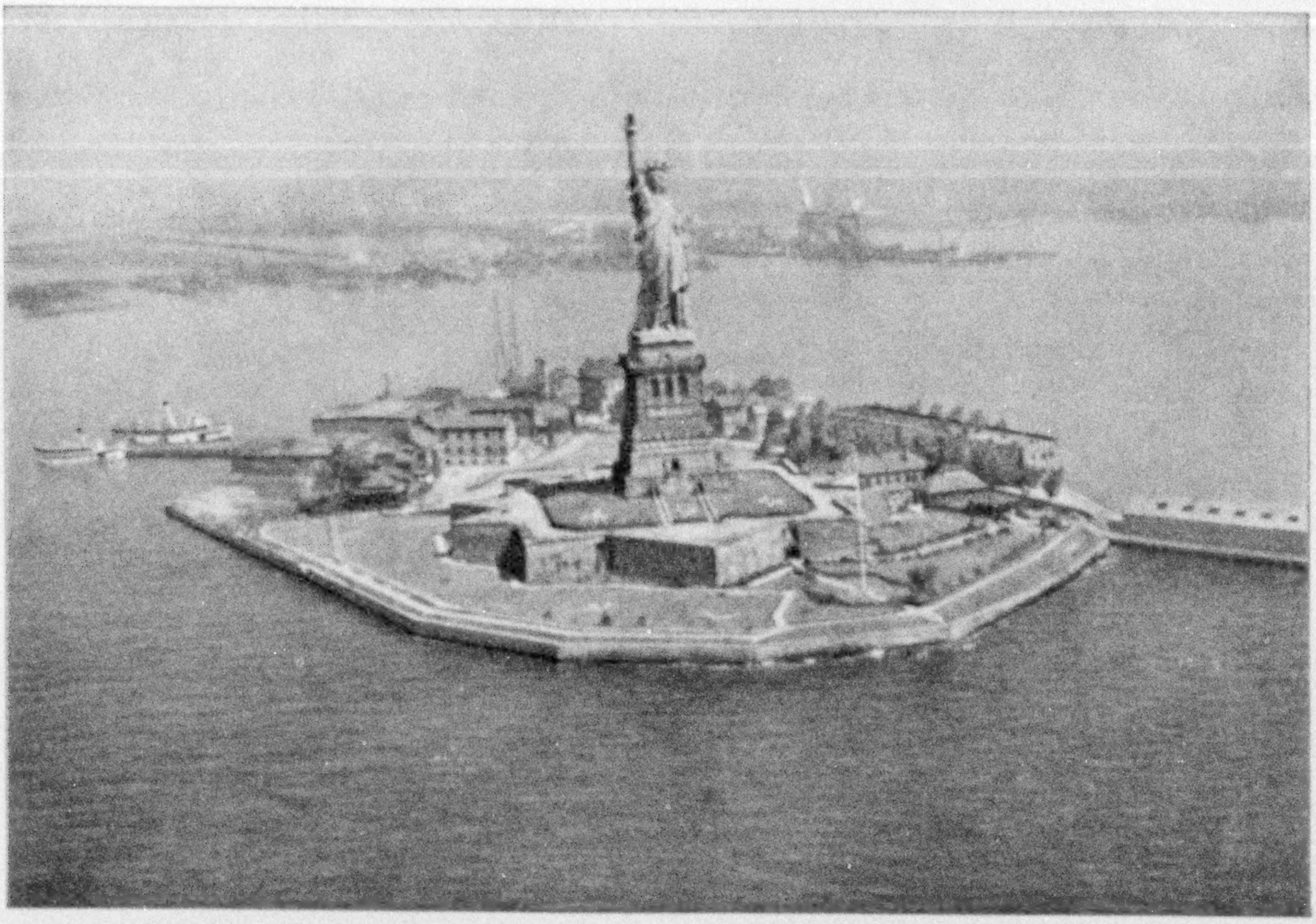
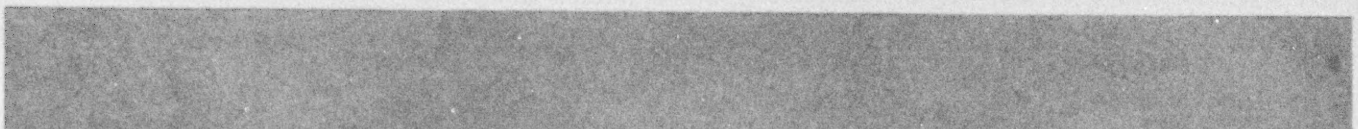
*See "First Autochromes from the Ocean Bottom: Marine Life Along the Florida Keys Is Successfully Photographed in Colors," by W. H. Longley and Charles Martin, in the NATIONAL GEOGRAPHIC MAGAZINE for January, 1927.

† See "First Natural-Color Photographs from the Arctic," in the NATIONAL GEOGRAPHIC MAGAZINE for March, 1926.



MISS AMERICA POSES FOR HER FIRST AËRIAL PORTRAIT IN COLOR

The Navy Airship *ZMC 2* on its way to New York saluted the Statue of Liberty by dipping to 300 feet.

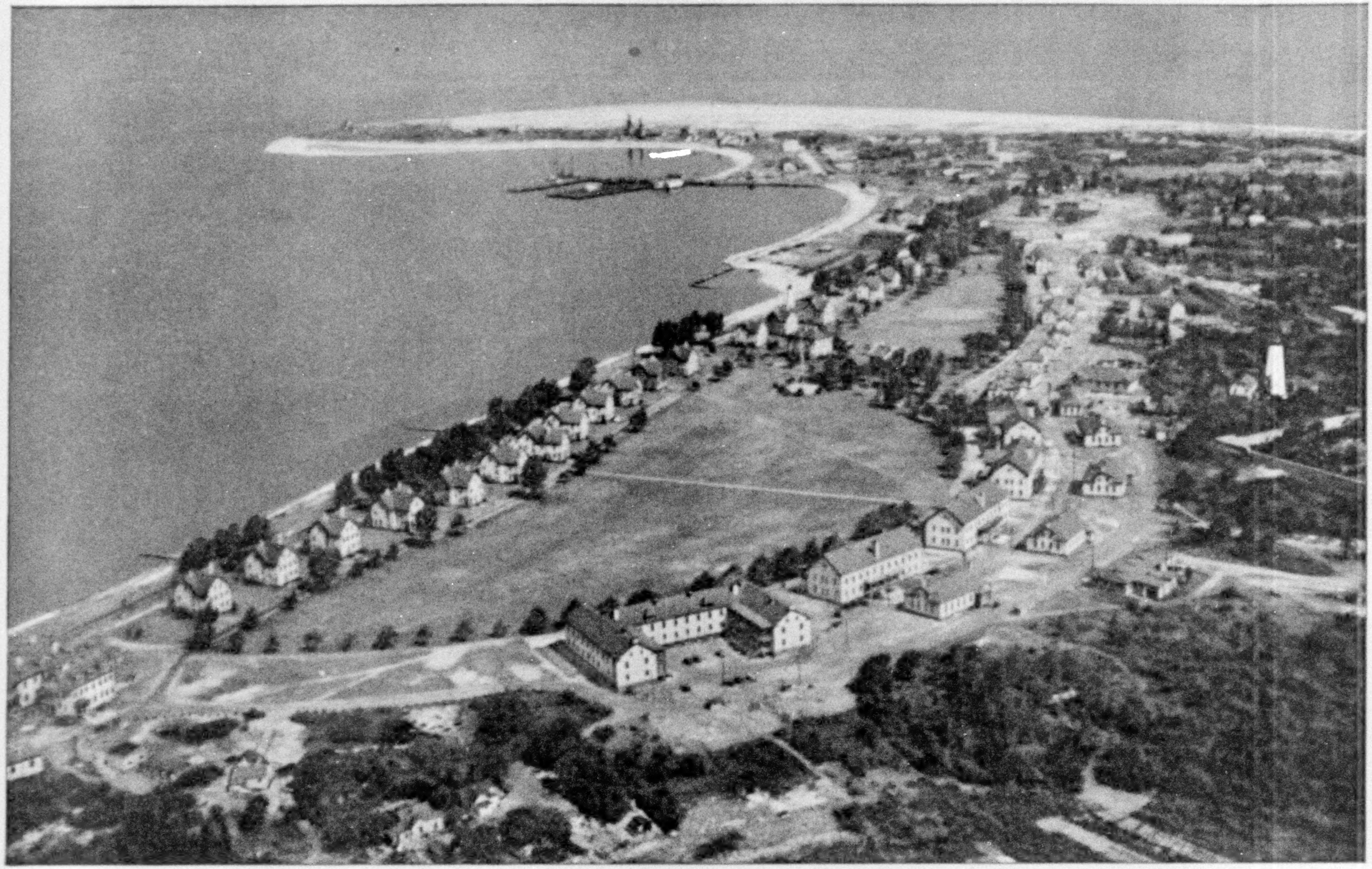


© National Geographic Society

Finlay Direct-Color Photograph

THE "LANCASTRIA" INWARD BOUND TO HER NEW YORK BERTH

A fine haze, spreading like a thin veil between the airship and the water, dims the Statue of Liberty and Ellis Island in the distance.



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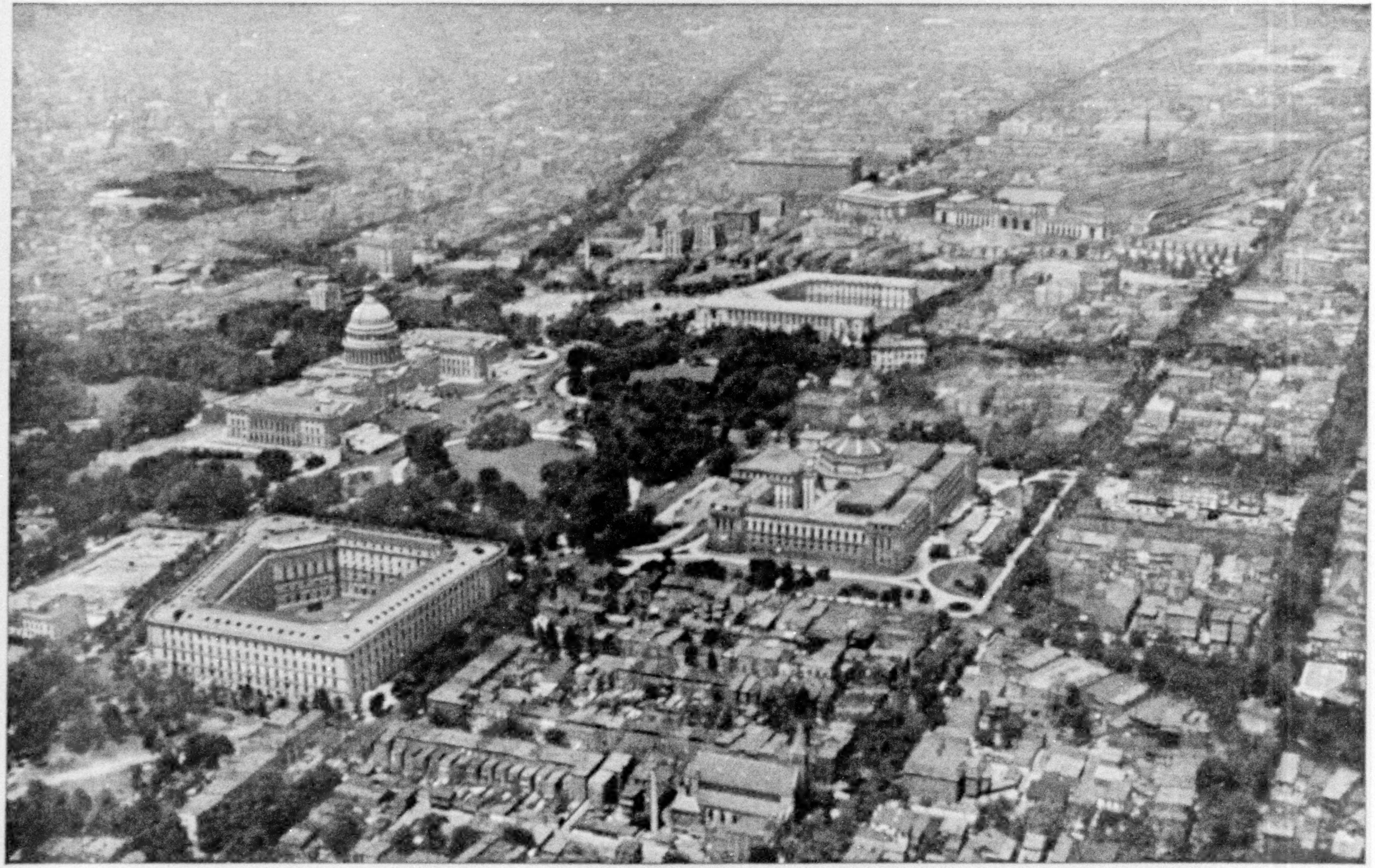
Finlay Direct-Color Photograph

SANDY HOOK'S FLAT TONGUE OF SAND PROTECTS THE NARROWS OF NEW YORK HARBOR

Fort Hancock, the principal feature of this famous spit pock-marked with gun emplacements ancient and modern, is one of the land defenses of America's metropolis. The white lighthouse, a familiar landmark to mariners since 1764, is the oldest standing light tower in the United States.



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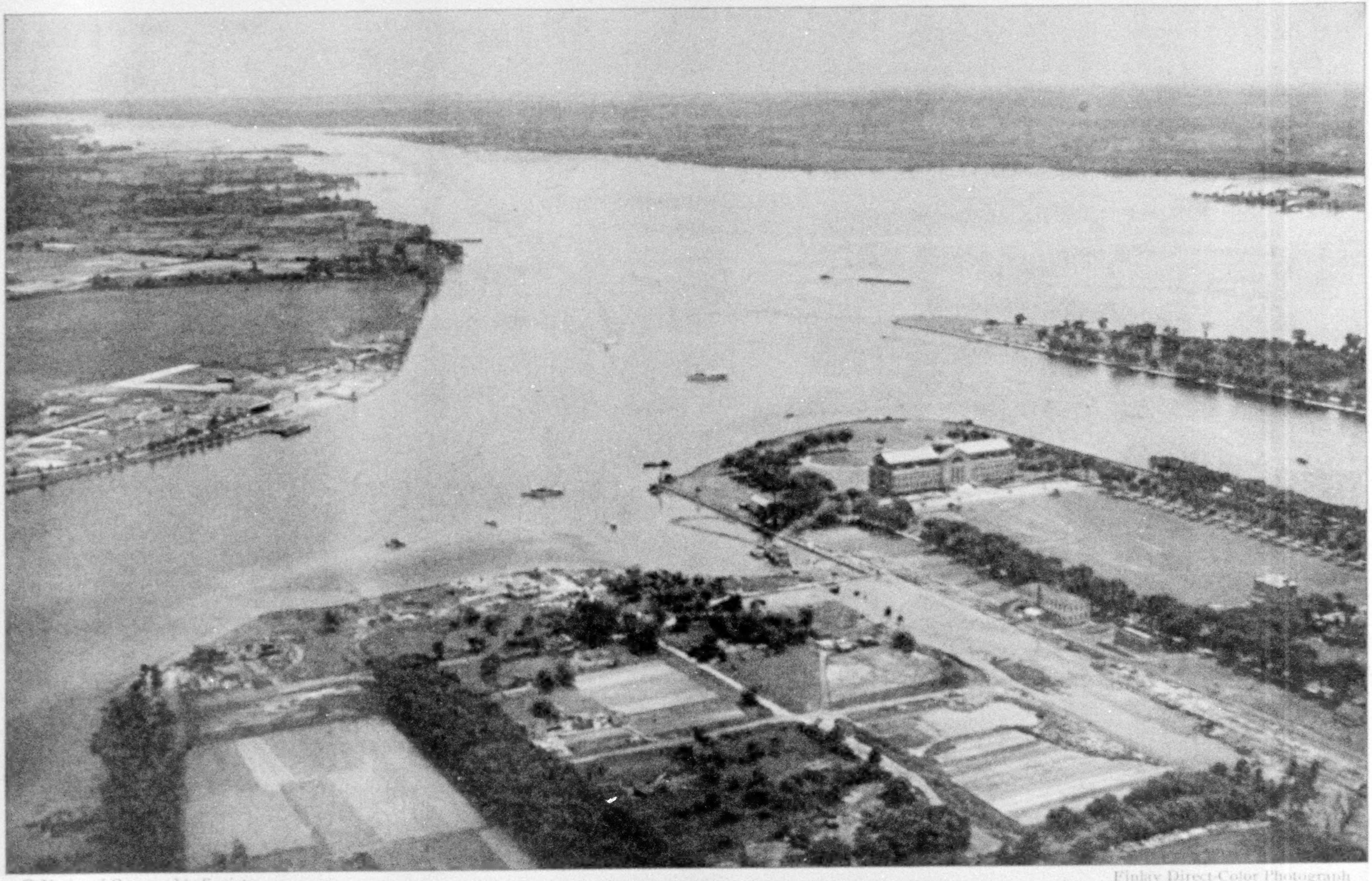
Finlay Direct-Color Photograph

THE HEART OF THE NATION'S CAPITAL IS THE SUBJECT FOR THE FIRST SUCCESSFUL NATURAL-COLOR PHOTOGRAPH FROM THE AIR

The domed Capitol is flanked by the House and Senate Office Buildings, with the Library of Congress in the central foreground. The Folger Shakespearean Library is under construction at the right. In the plot to the left of the House Office Building (foreground) will rise the new House Office Annex and to the north of the Library of Congress, facing the Capitol, the new Supreme Court Building is to be erected.



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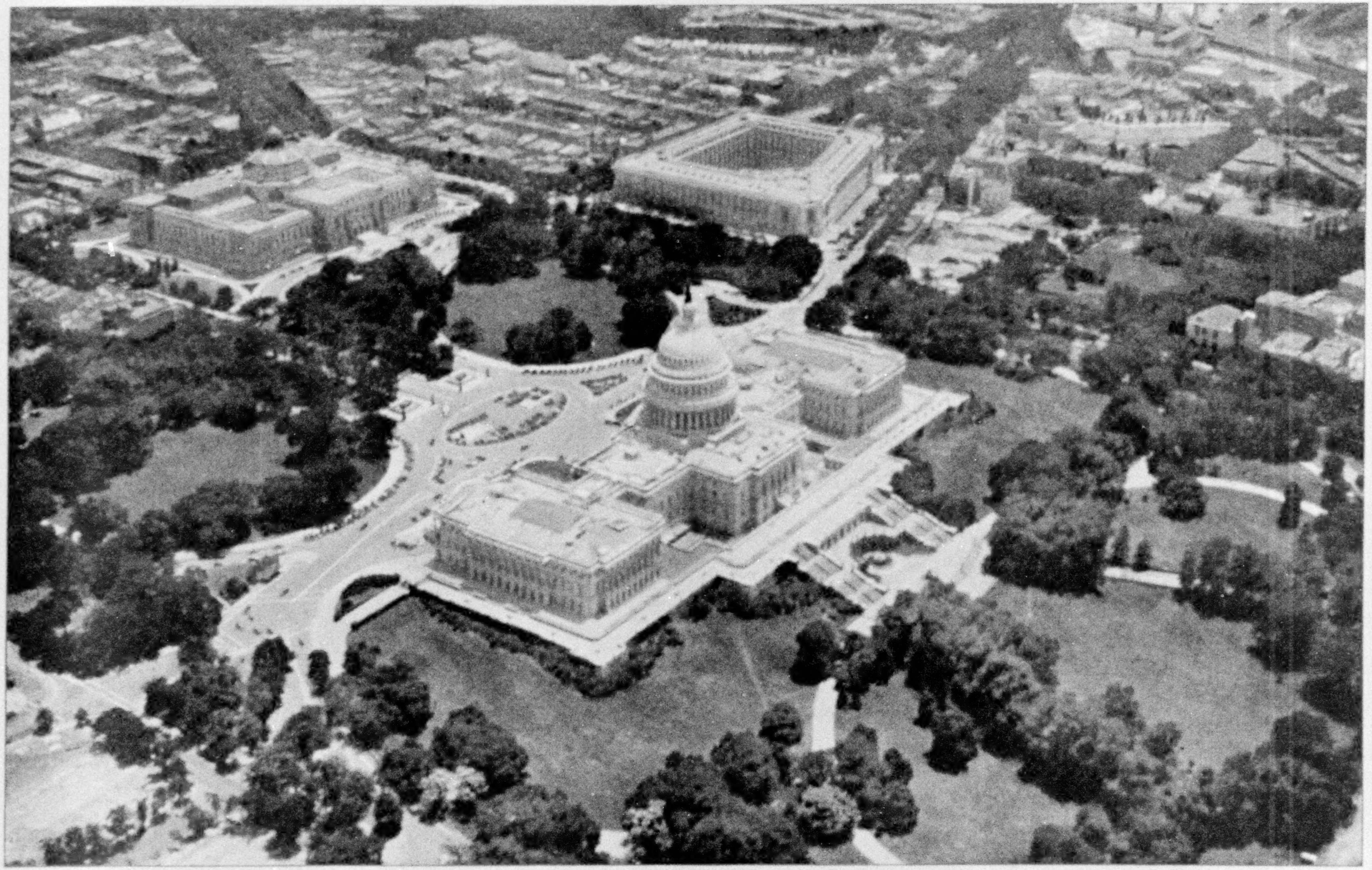
Finlay Direct-Color Photograph

THE BROAD EXPANSE OF THE POTOMAC AT ITS JUNCTION WITH THE ANACOSTIA RIVER

Up the Potomac's 24-foot dredged channel from Chesapeake Bay and the Atlantic come vessels as large as the U. S. Cruiser *Memphis,* which brought Colonel Lindbergh home from Paris. Anacostia Naval Air Station, where many world air records have been set, is seen at the mouth of the Anacostia River on the left. The Army War College, with its tree-lined campus, rises on the middle peninsula in the right foreground between the now abandoned James Creek Canal and the Washington Channel. Hains Point, bordered by the Potomac Park speedway, is next.



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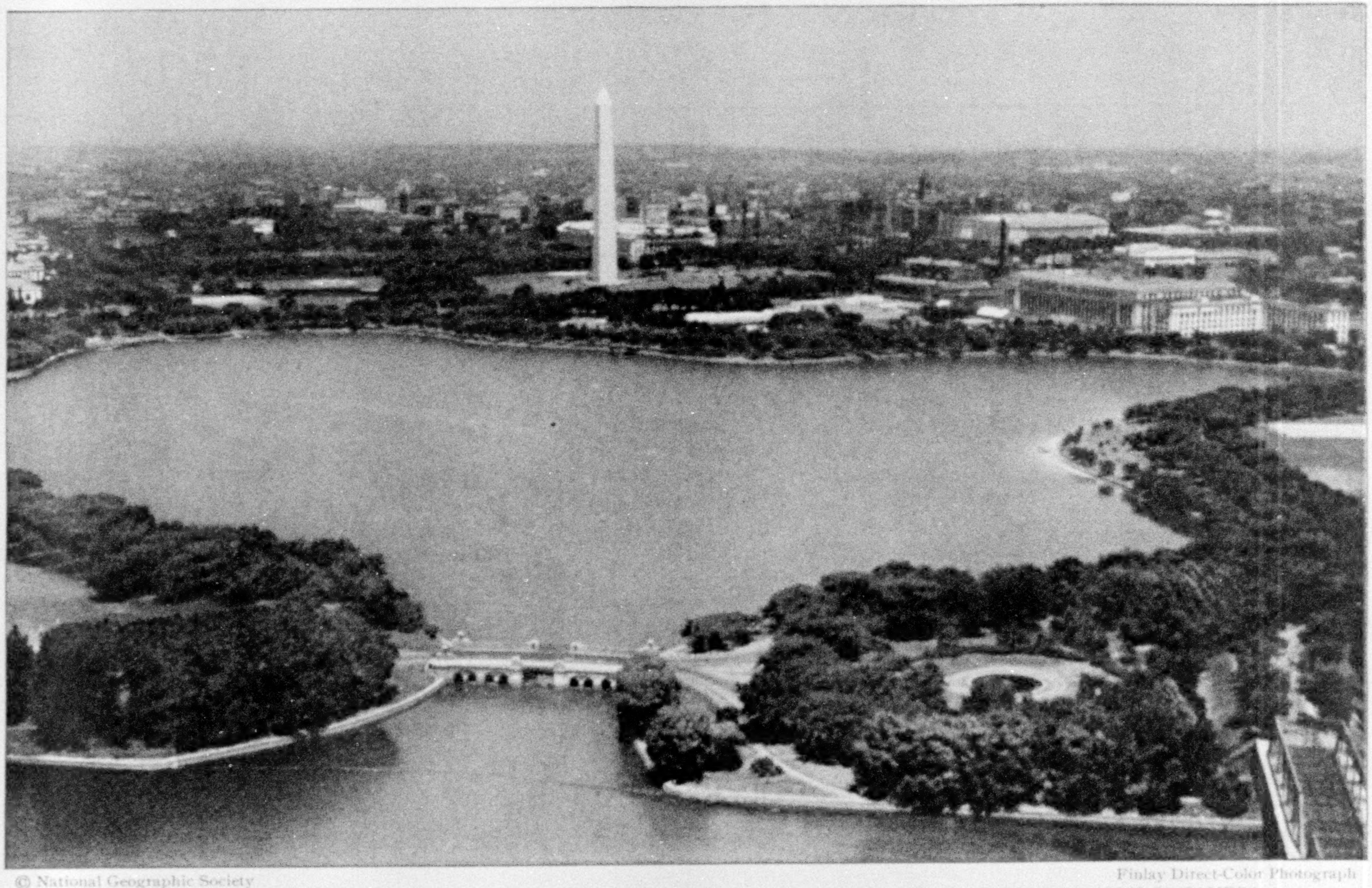
Finlay Direct-Color Photograph

AT AN ELEVATION OF 1,200 FEET THE NATION'S CAPITOL RESEMBLES A GREAT WHITE BANQUET CAKE

The grounds surrounding this magnificent structure, especially in the lower left toward the Union Station, are at present being developed by landscape artists under the direction of the National Commission of Fine Arts (see, also, Color Plate III).



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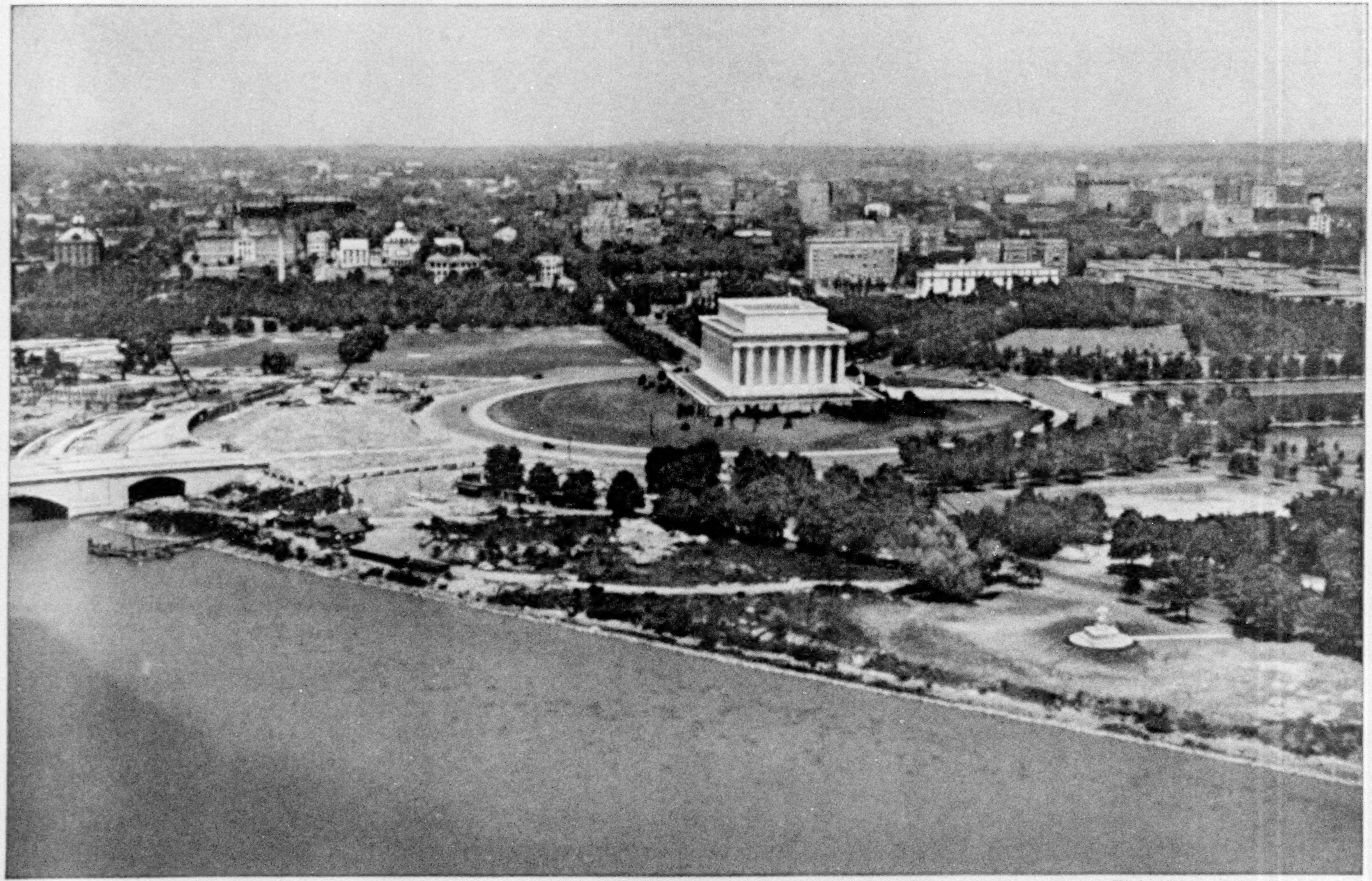
Finlay Direct-Color Photograph

THE MOST FAMOUS MONUMENT OF THE NEW WORLD VIEWED FROM ALOFT THROUGH THE LENS OF A COLOR CAMERA

Visitors come from every State in the Union in April to view the blooming of the Japanese cherry trees which encircle this tidal basin. The White House, flanked by the State, War, and Navy, and Treasury Buildings, is seen through the trees at the left. Behind the Monument is the new Commerce Department Building, which, when completed, will be the largest in Washington. At the right is the Bureau of Engraving and Printing.

XUM



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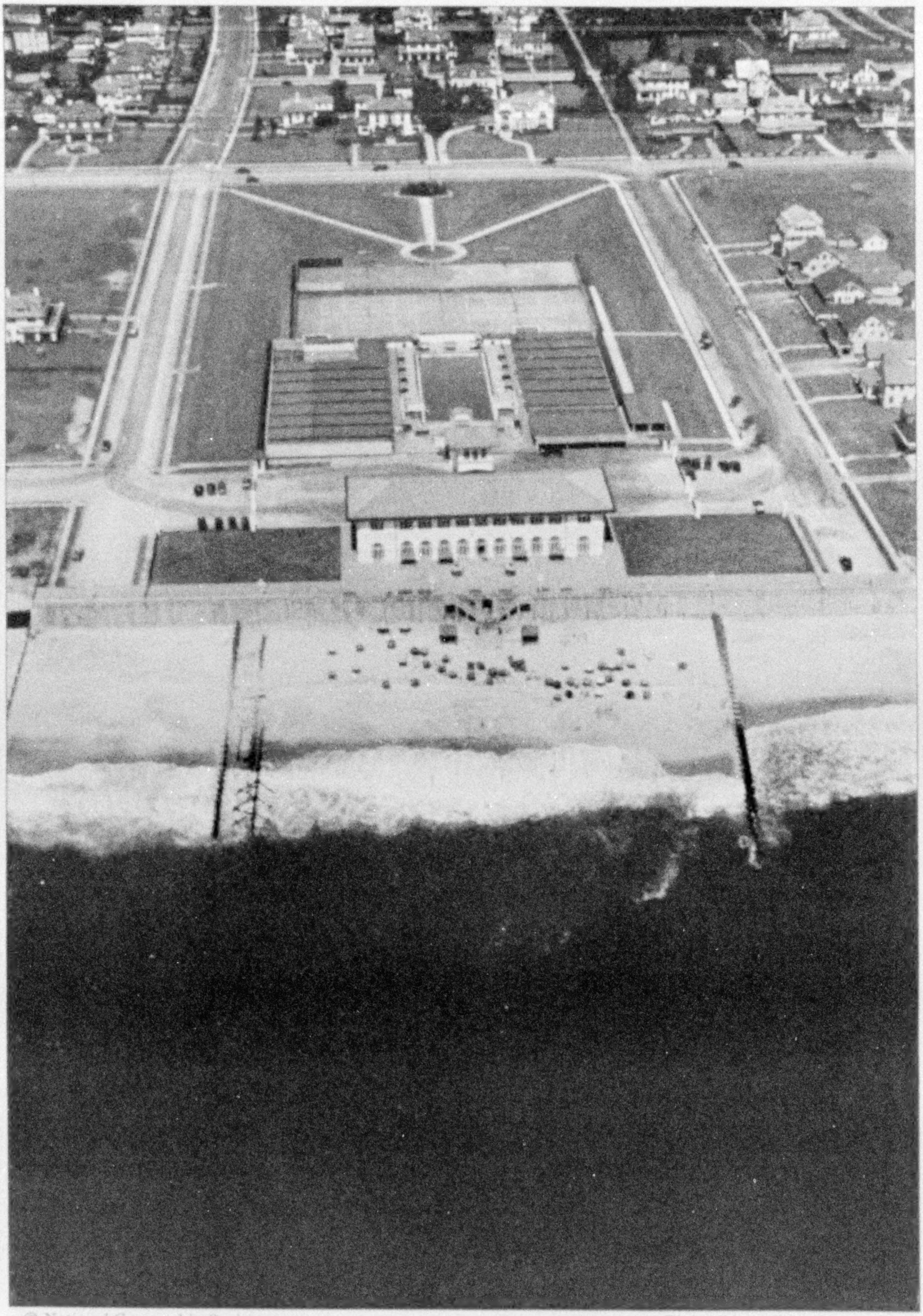
Finlay Direct-Color Photograph

A PERPETUAL SHRINE OF BEAUTY: THE LINCOLN MEMORIAL

When the Arlington Memorial Bridge is dedicated in George Washington's bicentennial year, the Mall, extending from the Capitol to the Lincoln Memorial, will be directly connected with the Arlington Amphitheater and National Cemetery. The group of buildings in the left background houses the United States Naval Hospital; the white structure to the right is the National Academy of Sciences. The monument in the lower right foreground is in memory of John Ericsson, inventor of the *Monitor*, famous in American naval history.



© National Geographic Society

Finlay Direct-Color Photograph

A BATHING CLUB NEAR ASBURY PARK, NEW JERSEY, REFLECTS A KALEIDOSCOPE OF COLOR TO THE AËRIAL CAMERA

The National Geographic Society's pioneer experiments in aërial color photography are expected to be of value to the map maker and highway engineer. By means of the correct rendering of color values, camouflaged objects and natural features not apparent in the ordinary black and white photograph are made clear.

brought home by the chief technician, while not as yet sufficiently sensitive to make color pictures from swiftly moving airplanes, have been adapted for use from a dirigible, and the accompanying nine illustrations are presented as examples of a pioneer experiment and will, it is hoped, as in the case of the sea-floor studies, attract the interested attention of students of photography everywhere.

The photographs were made by the writer during a series of flights in the Goodyear-Zeppelin dirigible *Mayflower* and the U. S. Navy's new all-metal *ZMC-2*. Both airships were generously made available to the National Geographic Society for this important experimental work. The Navy's Bureau of Aëronautics was especially anxious to further the effort to make successful natural-color air photographs because of their potential value in the study of camouflaged areas, ships, and gun emplacements.

IDEAL WEATHER CONDITIONS SOUGHT

Ideal weather conditions were sought in order to make these first pictures, and numerous difficulties were encountered before brilliant light and a comparatively calm and hazeless atmosphere came in conjunction.

The first successful natural-color photograph made was of the National Capitol, reproduced on Plate III. When the photographer was in position for the proper composition, the pilot in charge of the *Mayflower* was given a signal, the motors were momentarily cut off to eliminate vibration, and the big bag floated quietly while the brief exposure was made.

Frequently the photographic voyages consisted of shadow-chasing, the pilot and the photographer estimating when a certain scene below would emerge into bright sunlight and then navigating the airship into correct position, so that, with engines silenced, it would attain equilibrium at the right moment. Sometimes, after scurrying over Washington at express-train speed, the ship would arrive at the desired spot just in time to have a wisp of cloud form between the scene and the sun, and thus make the attempt futile.

The photographs of the environs of New York and of Asbury Park were made in bright June weather from the cabin of the *ZMC-2*, which operates from the great aëronautical base at Lakehurst, New Jersey. On the way to New York the airship flew over what seemed to be immense patches of parched brown, reminders of the ravage caused by forest fires the year before. Occasionally these seared areas extended as far as the eye could see, with here and there the charred upstanding skeletons of buildings where formerly villages flourished.

As the ship approached the shore line, inlets and landlocked bays resembling large pans of water came into view. Each white sand bar and green patch of seaweed in the shallows was clearly etched upon the landscape.

Not until he travels with possibilities of the natural-color camera in mind does the airman fully appreciate the brilliance and the variety of the kaleidoscope that is constantly passing beneath him. Every wavelet, every bit of greensward, every individual in herds of sheep and cattle, and the red, brown, and green roofs of houses reflect their varied color notes in Nature's magnificent panorama.

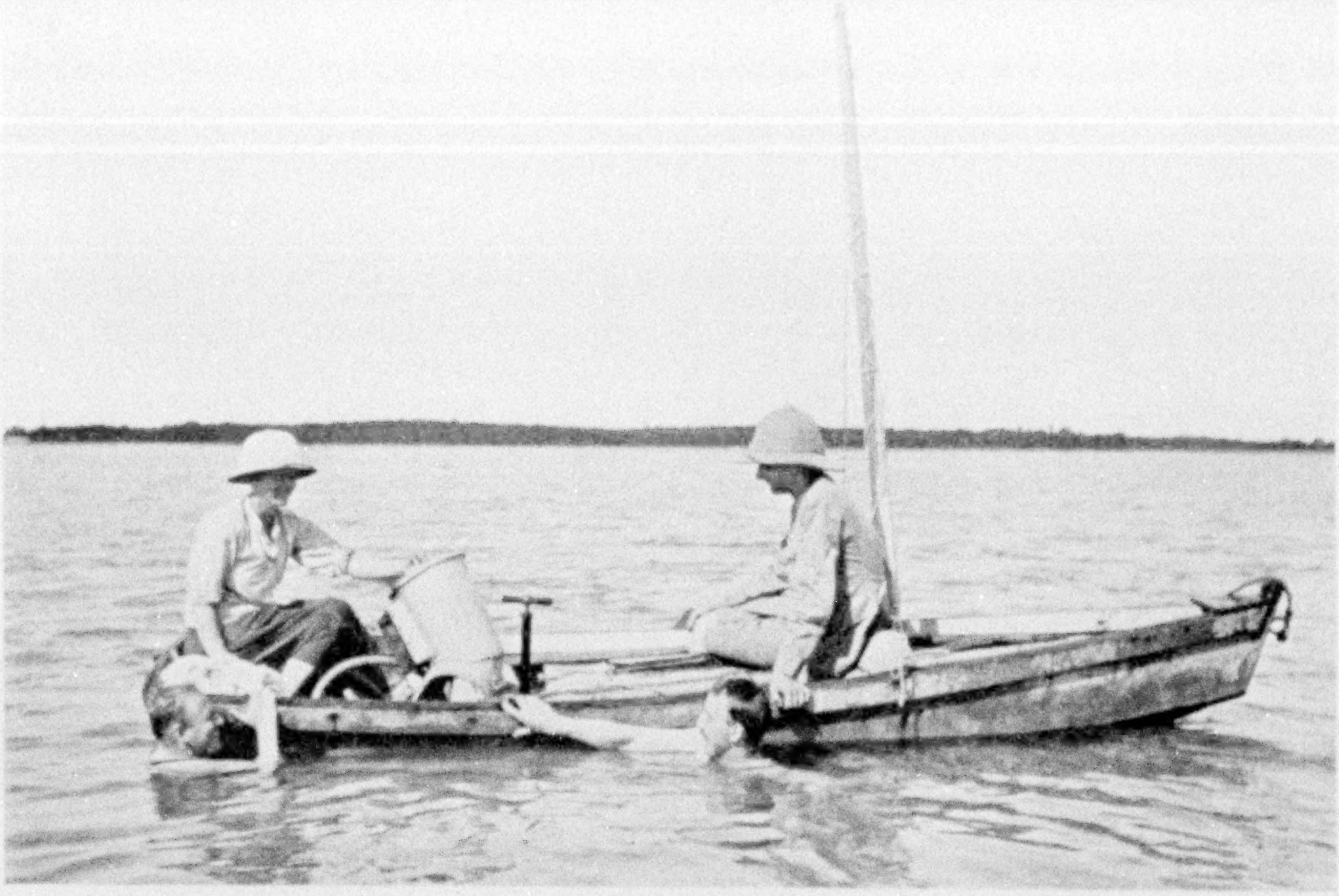
As the all-metal ship flowed along like an ocean liner in a heavy swell, it would skim one moment over some great summer-resort hotel; the next it would delight thousands of interested bathers on the beach; then slip over the slow-rolling blue-and-mottled surf.

NEW YORK HIDES BEHIND A HAZE

Much of Greater New York and its matchless harbor were seen as through a gossamer veil, a condition which the Navy's air skipper assures the writer is frequently encountered.

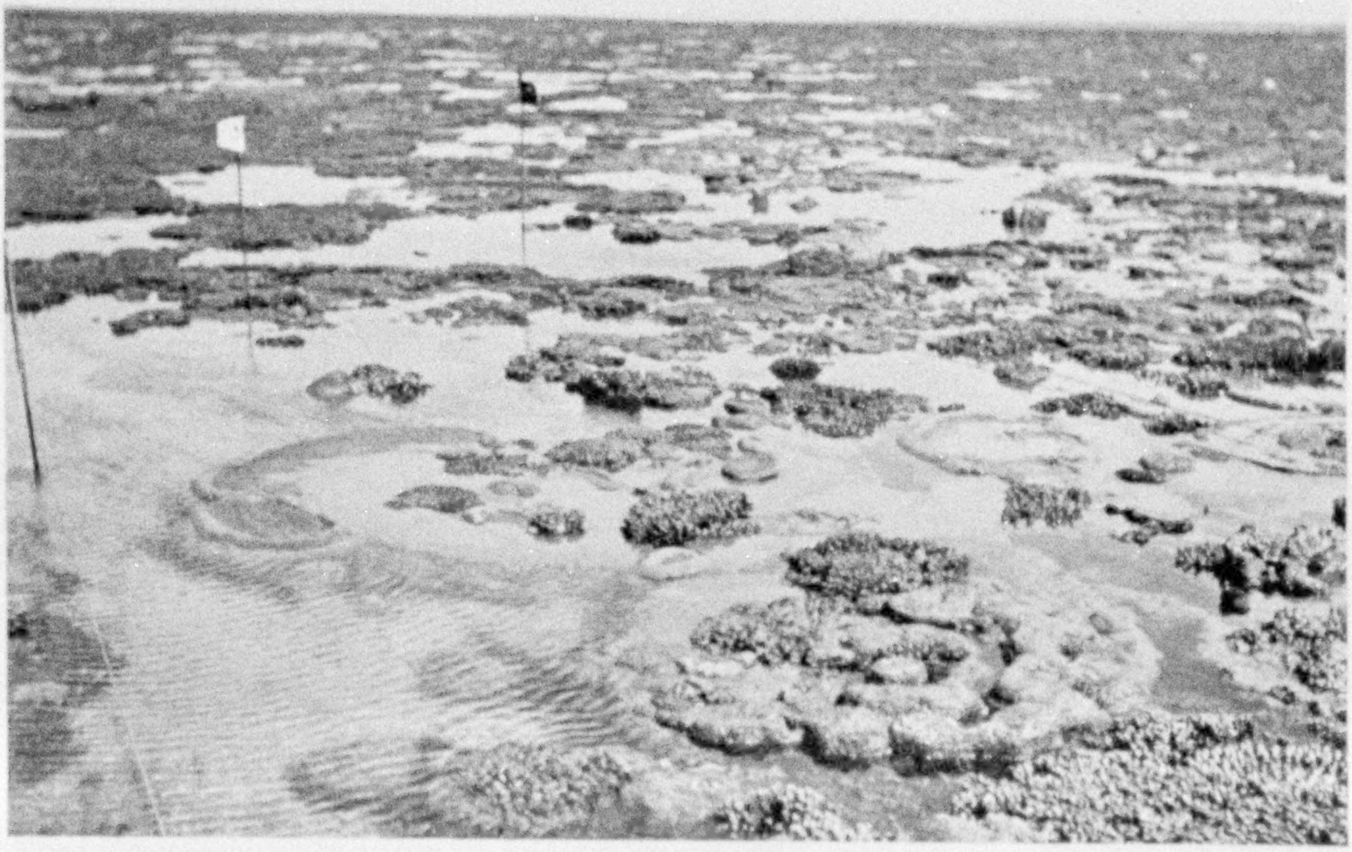
Approaching the earth's surface, the atmosphere contains many almost prismatic tints and shades that cannot be detected by the human eye and, consequently, are hard to believe when recorded on the color-plate through the camera's eye.

With the rapid strides now being made in accelerating the speed of the photographic plate, it is anticipated that these first natural-color air views will be followed in the not-distant future by natural-color scenes made from rapidly moving airplanes, when air currents and a flawless sky will not necessarily determine the subjects for reproduction.



SPYING IN SUBMARINE GARDENS OF THE GREAT BARRIER REEF

The diving helmet was used by scientists at Low Island for observations among the coral at various depths in Australia's Grand Canal (see text on opposite page).



Photographs by Charles Barrett

LIVING CORAL AS IT APPEARS AT LOW TIDE

These patches are a lovely purple; other kinds are golden-brown, emerald-green, and rose-tinted. Among them dart gay little fishes, while gorgeous sea anemones "blossom" from the sand.

THE GREAT BARRIER REEF AND ITS ISLES

The Wonder and Mystery of Australia's World-Famous Geographical Feature

BY CHARLES BARRETT

Author of "In Australian Wilds," etc., Editor of "The Victorian Naturalist"

IF THE sea went dry along the east coast of Queensland, a thousand miles of coral "maze" would be revealed. The Great Barrier Reef of Australia must not be imagined as a continuous structure, like the Great Wall of China; it is formed by innumerable reefs, and a map of just one section resembles a complex jig-saw puzzle. Then there are the isles, mountainous and forested, of the inner zone, and the atolls and cays that are true coral islands.

For nearly a century the Great Barrier has intrigued science by the problems that it presents to geologists, physiographers, and naturalists. It has lured such masters of marine zoölogy as Alexander Agassiz and A. G. Mayer from America, and recently a British expedition broke camp after a year on Captain Cook's first coral island.

In all the Seven Seas there is nothing so wonderful as this vast submarine "curtain" of coral, the largest coral reef in the world, whose nature and origin remain half-veiled in mystery.

A GRAND SEA CANAL

Tourists from many lands and thousands of Australians have made the voyage through "Australia's Grand Canal," the area between the mainland, with its purple hills, and the Outer Barrier. A calm and pleasant trip during a portion of the year, it may be perilous in the cyclone season.

Many launches and fishing craft have been wrecked among the coral, or gone down in the heart of a storm within the Barrier. But navigation is no longer the nightmare it was to the early voyagers, before the reef mazes had been mapped and routes safe for even large vessels discovered. Danger exists still, but the old fear has gone—the haunting fear of disaster in the Realm of Coral.

Majestic is the meeting of league-long rollers of the ocean and the Great Barrier. On days when the sunlit water behind the coral bastion is calm enough for a canoe, mountainous waves pound the reefs unceasingly. The surf on the Outer Barrier at high tide, when the broad reefs' crests are hidden, presents an amazing spectacle. A "long line of boiling surf, springing up in mid-ocean without any apparent cause," is the late Charles Hedley's description. That great naturalist, whose knowledge of the Barrier was unrivaled, devoted the last few years of his life to the study of its problems.

NEPTUNE'S TEETH IN ROWS

Swain Reefs, far south, mark the beginning of the Great Barrier Outer System. Farther north, the linear reefs are developed. They are some miles in length and up to half a mile across, with broad separating channels.

A lighthouse on Lady Elliot Islet marks the southern limit of coral-formed land, "a broad platform of solid coral half a mile in circumference." Then comes an archipelago, the Bunker Group, followed by the Capricorn Group, popular resort now of naturalists, and almost a picnic ground for holiday-makers from the mainland.

Within the Tropics, the maze is multiplied. From a hill at Cooktown, you may see, as Captain Cook did in 1770, the shadows of the coral reefs wherever you look out to sea. The navigator who explored 2,000 miles of the east coast of Australia was ignorant of the existence of coral in those waters when his ship struck on Endeavour Reef at night.*

Had the weather been stormy she must have been lost, for coral fangs had pierced her hull. But calm sea enabled the sailors to "patch up" the bark by "fothering," and Cook sailed her to the beach for careening and repairs. Meanwhile, gazing from the hilltop, he discovered the coral.

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* See, also, "The Columbus of the Pacific," by J. R. Hildebrand, in the NATIONAL GEOGRAPHIC MAGAZINE for January, 1927.

Photograph by Charles Barrett

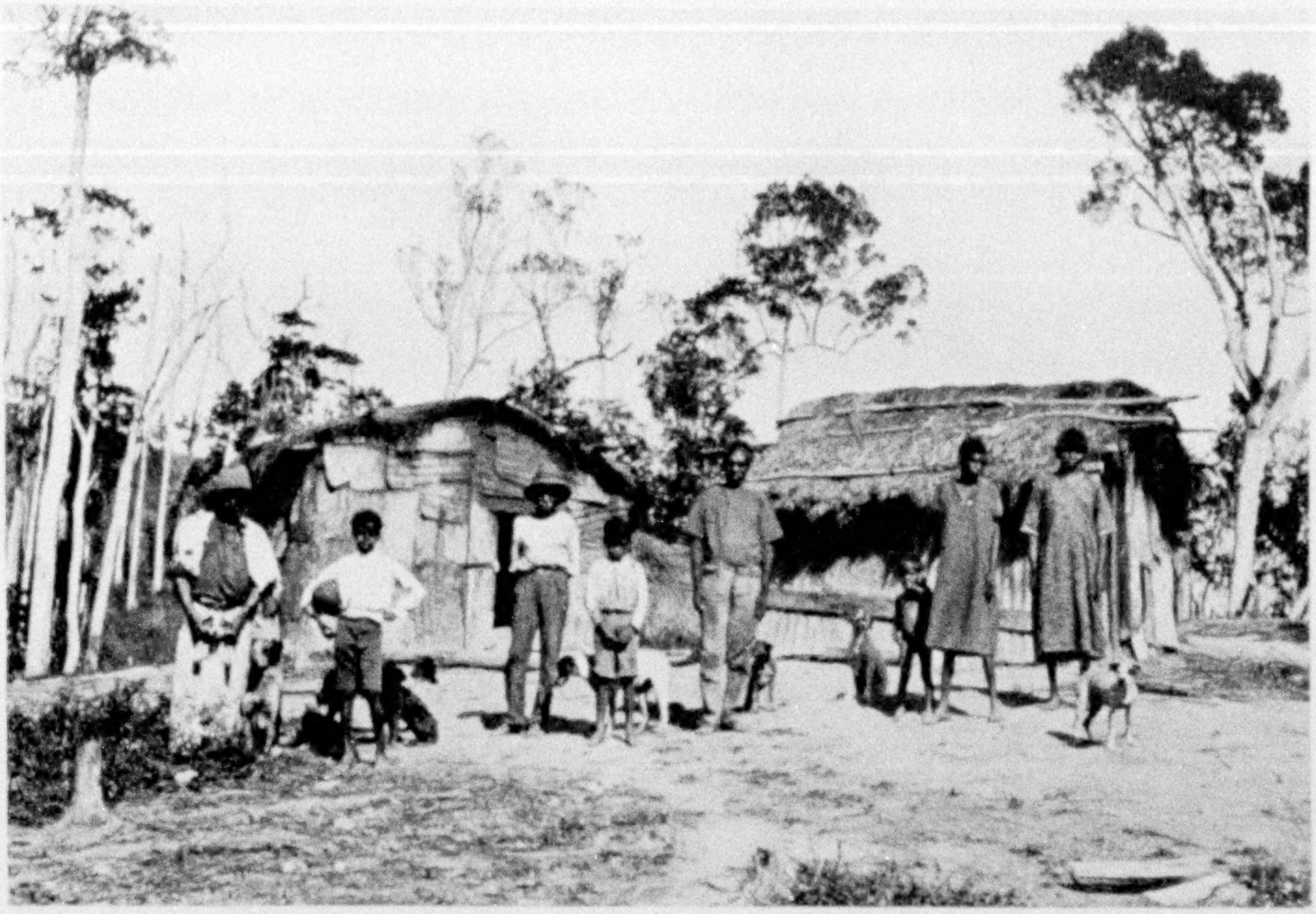
THE BUTTERFLY HUNTER HAS FEW DULL DAYS ON THE BARRIER REEF

Gorgeous butterflies, including "bird-winged" forms, float about tropical island blossoms.

Photograph by Capt. Frank Hurley

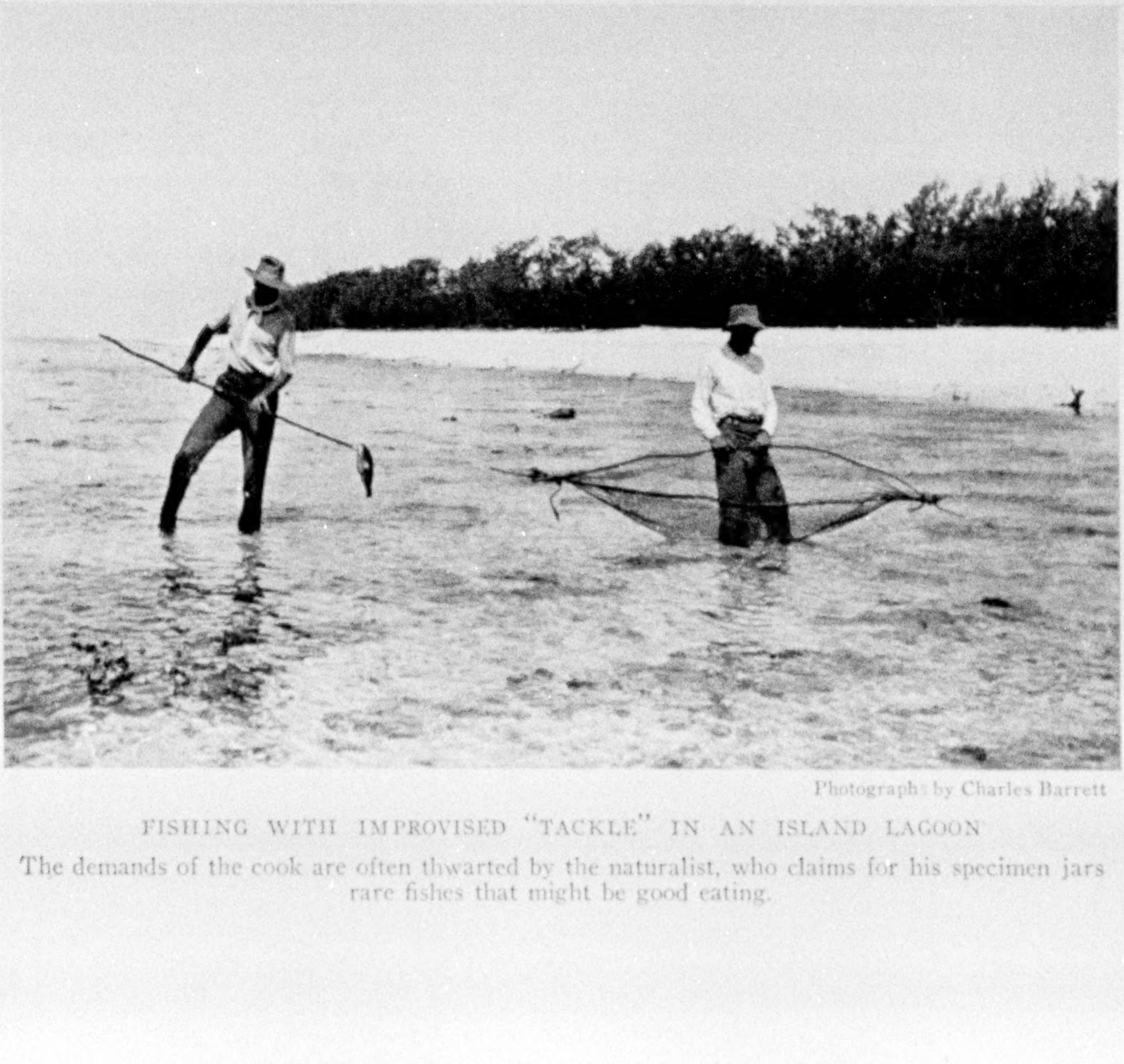
FISHING AMONG THE CORALS

The root of a certain vine, pulped and immersed in the pools, drugs the fish, so that they may readily be caught by hand by this native of the Murray Islands, in Torres Strait.



IN A HILLTOP VILLAGE OF NORTH QUEENSLAND ABORIGINES

Civilization has put clothes on these natives, whose ancestors were cannibals.



Photograph by Charles Barrett

FISHING WITH IMPROVISED "TACKLE" IN AN ISLAND LAGOON

The demands of the cook are often thwarted by the naturalist, who claims for his specimen jars rare fishes that might be good eating.

Photograph by Charles Barrett

REFLECTIONS ON THE REEF

Scientists on Low Island, pegging out "claims." Some areas of the coral were kept fenced in for months, and daily observations on the animal life within were recorded. Thus was the growth of trochus shells studied.

With a seaworthy ship again, he won a way out of the maze, gaining open ocean through one of the great openings in the Barrier. He escaped many dangers only to meet with others a few days later.

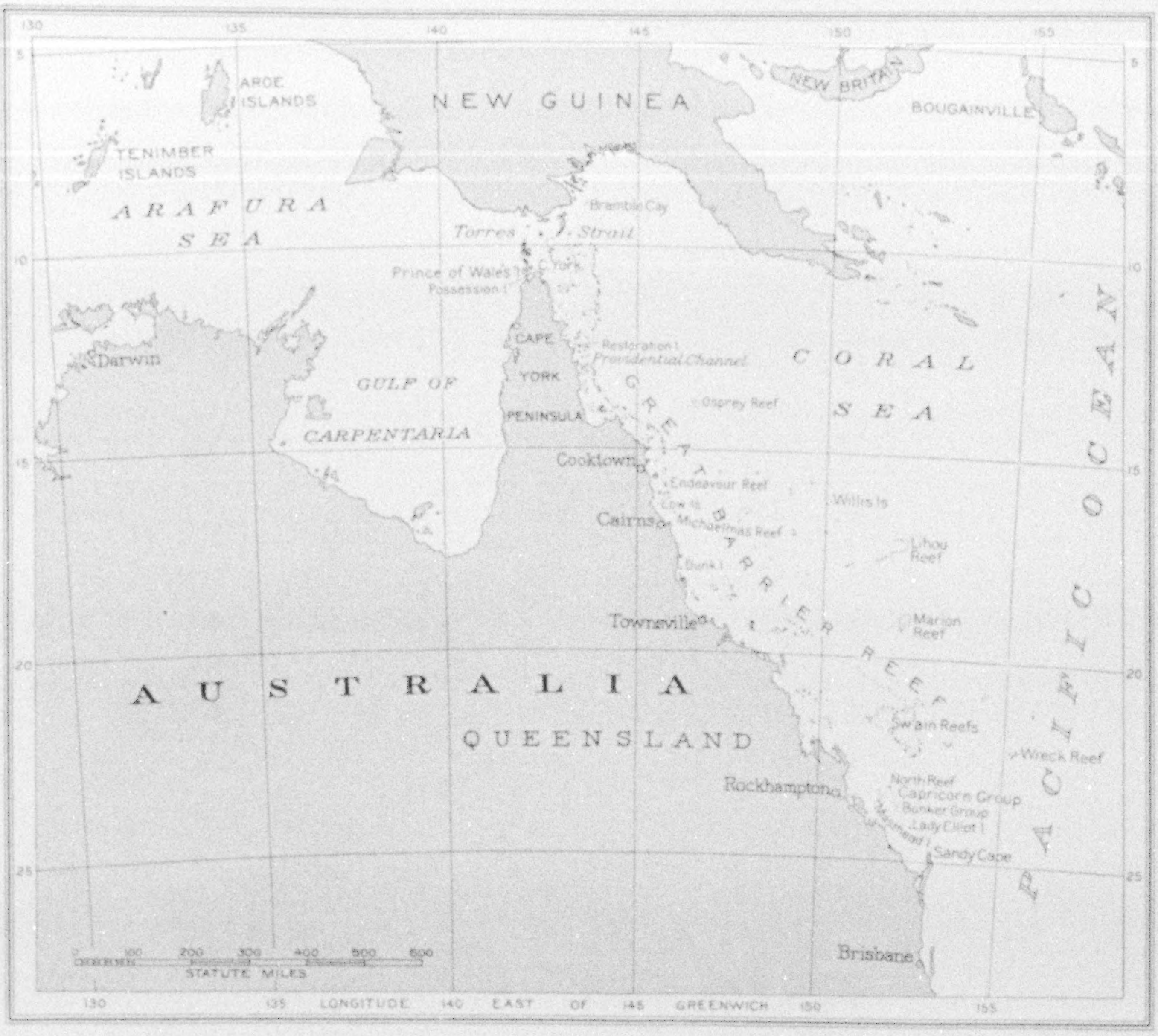
The *Endeavour,* becalmed off the Outer Barrier, was borne toward the reef. She rose at last on a huge wave and seemed doomed to destruction, with only the breadth of a wave between her and the coral. But "a light air of wind sprung up," and the ship was saved.

Captain Cook sought eagerly for an opening, and found his "Providential Channel." He was in our Grand Canal once more, and with infinite care took the bark to Torres Strait. Landing on an island which he named "Possession," he claimed the whole eastern coast of Australia for Britain, in the name of King George III.

A memorial to Captain Cook has been erected on Possession Island by the Federal Government, a simple obelisk bearing a tablet of bronze.

BLIGH OF THE "BOUNTY"

Bligh, commander of the *Bounty,* and his 18 men who were faithful, made that memorable open-boat voyage from Tahitian waters to Restoration Island, within the Great Barrier, in 1789. The muti-


NEW GUINEA
NEW BRITAIN
BOUGAINVILLE
AROE ISLANDS
TENIMBER ISLANDS
ARAFURA SEA
Bramble Cay
Torres Strait
Prince of Wales I.
Possession I.
C. York
Darwin
GULF OF CARPENTARIA
CAPE YORK PENINSULA
Restoration I.
Providential Channel
CORAL SEA
Osprey Reef
Cooktown
Endeavour Reef
Low Is.
Cairns
Michaelmas Reef
Willis Is.
Lihou Reef
Bunk I.
Townsville
Marion Reef
GREAT BARRIER REEF
PACIFIC OCEAN
AUSTRALIA
QUEENSLAND
Swain Reefs
Wreck Reef
Rockhampton
North Reef
Capricorn Group
Bunker Group
Lady Elliot I.
Sandy Cape
Brisbane
STATUTE MILES
0
100
200
300
400
500
600
LONGITUDE EAST OF GREENWICH
130
135
140
145
150
155
5
10
15
20
25

Drawn by James M. Darley

THE GREAT BARRIER REEF, A SUBMARINE CURTAIN OF CORAL

In all the Seven Seas there is nothing more extraordinary than the vast chain of reefs, atolls, and cays extending off the east coast of Australia—at once a challenge and a lure to men of science.

neers' victims reached the reef at midnight, or rather came within sound of the surf, and two days later found a passage to safety. The boat voyage was continued along the east coast of Queensland and through Torres Strait to Timor.

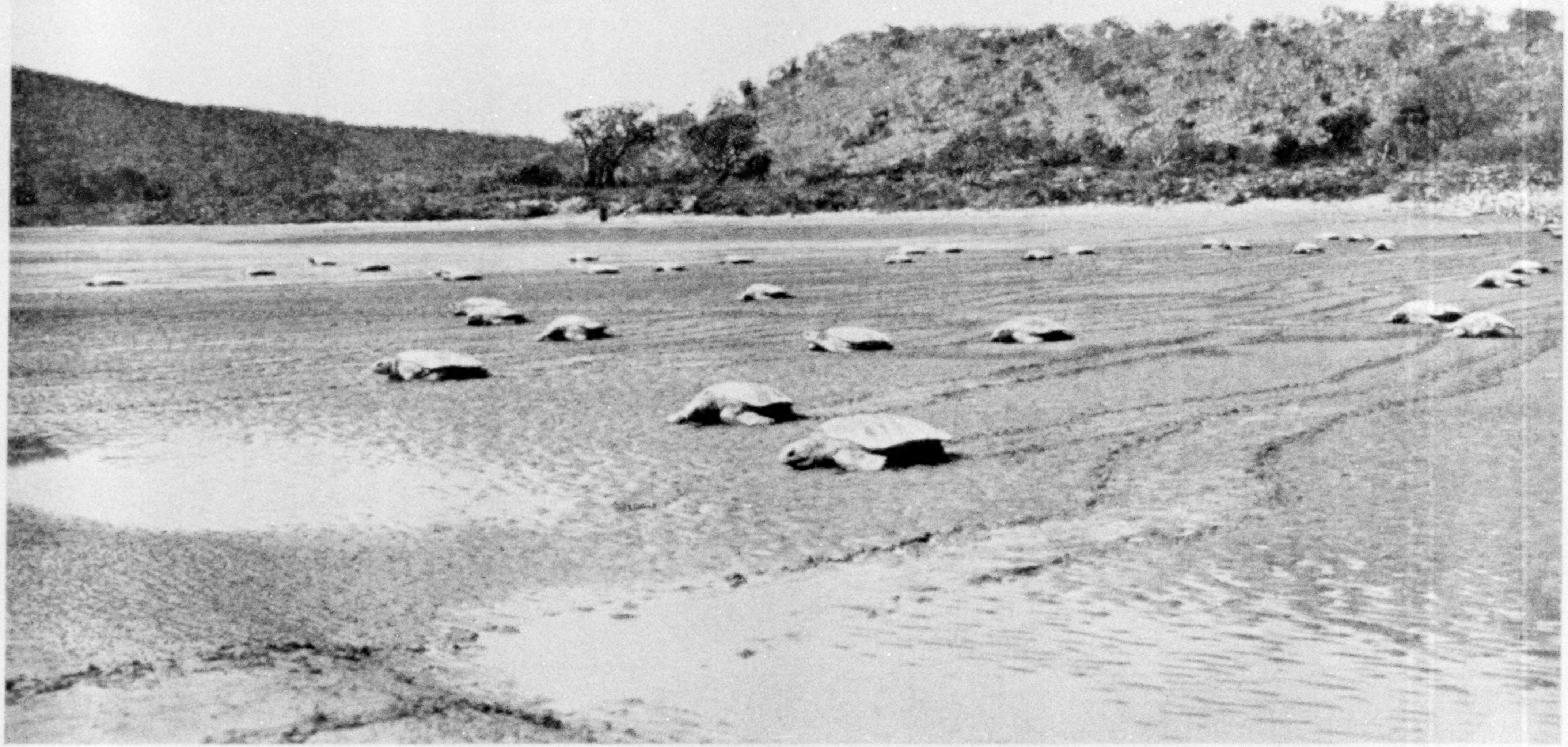
These old-time perilous voyages are discussed still in Australia. And round the campfire on a coral isle the talk may turn from Cook's discoveries and Bligh's amazing boat voyage to the recent loss of a launch, or the fate of a large steamer, sunk in a cyclone within a few miles of the mainland.

The Grand Canal varies in width from 20 to 80 miles. There are two regions, however. The inner one is narrow and fairly free from the perils which make the outer zone impossible for shipping. Only small craft are navigated among the reefs of the outer zone.

Luggers are sailed along the channels, with coral fangs threatening destruction—sailed often where the reefs are uncharted, in the quest for sea slugs and pearl and trochus shell. Japanese own many of these venturesome craft.

The depth of the sea outside the Great Barrier is profound, but in the zone where coastal steamers go safely it varies from about 10 fathoms to 20; the outer zone is much deeper, up to 70 fathoms.

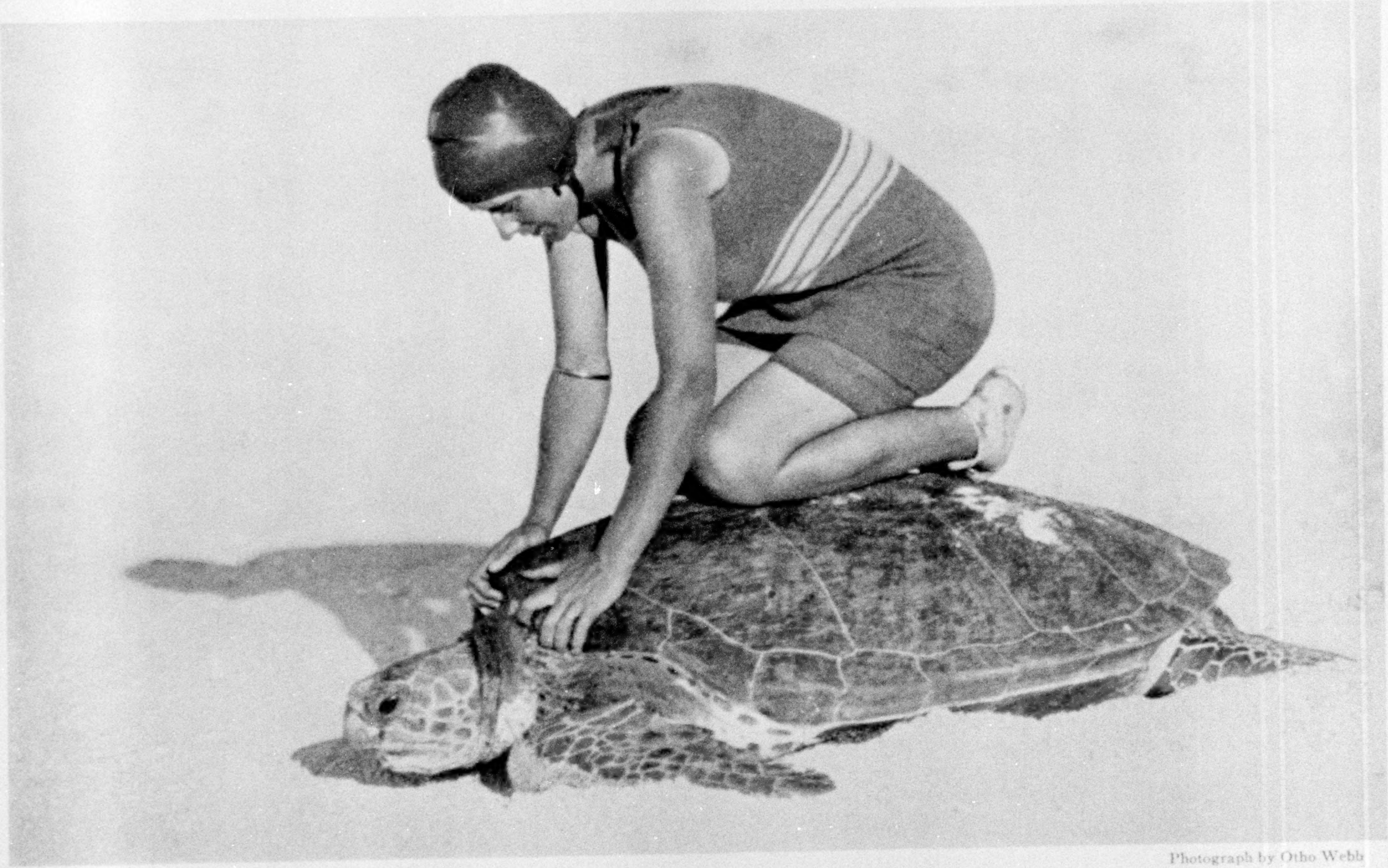
It is between these two zones that the mountainous islands lie, many of them beautiful and some the homes of happy people. Over hundreds of miles of sea they are strung, close together or with long gaps between.



Photograph by William Jackson

RACING TO THE SEA

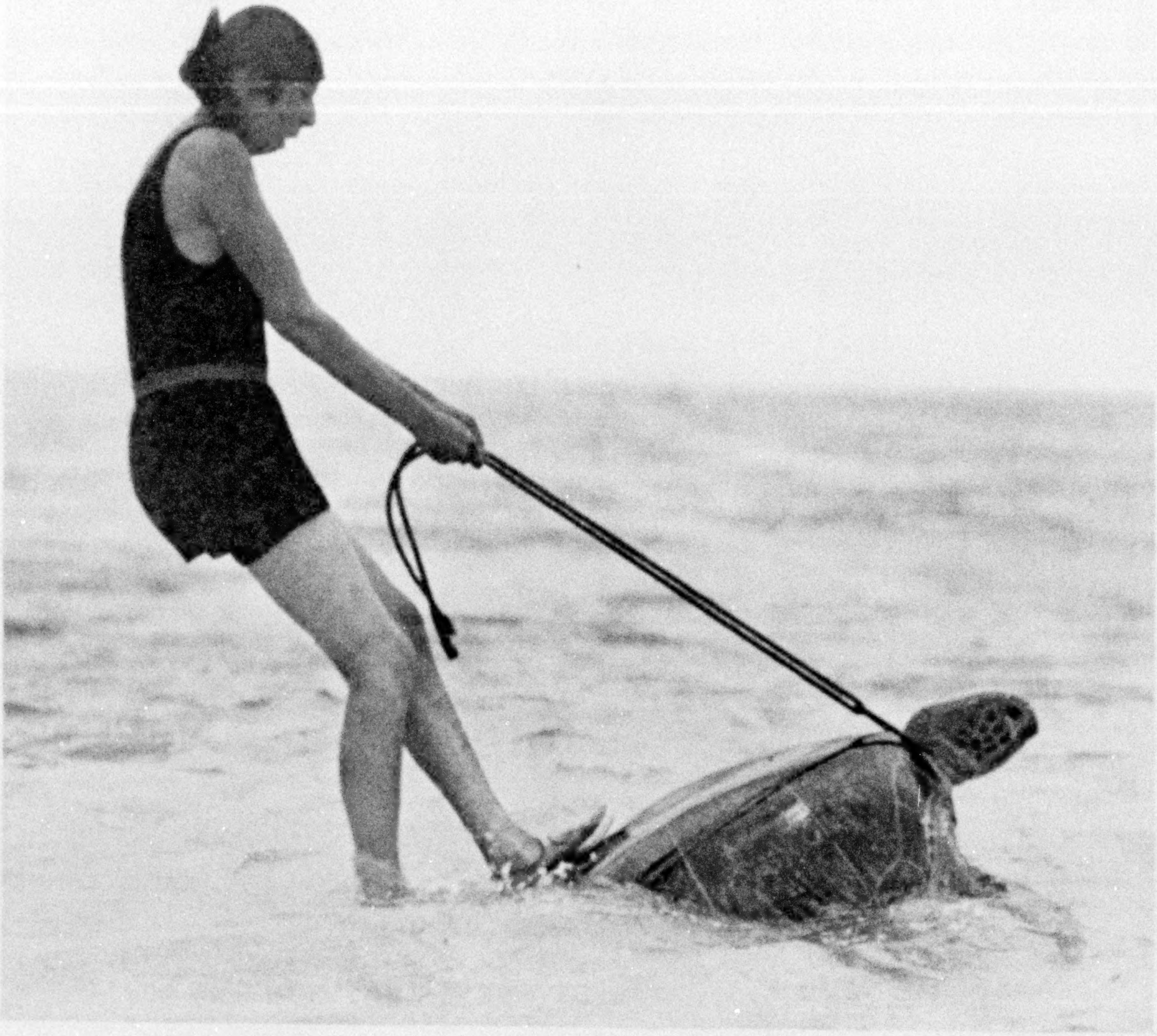
Sea turtles are seldom seen out of the water in the daytime. They steal ashore at night to lay eggs (see page 365). This beach is turtle-strewn because the creatures were captured and rendered helpless by turning them on their backs. In the morning they were released, and, in making for the sea, provided the cameraman with an excellent shot.



Photograph by Otho Webb

THE MERMAID AND HER STEED

On the beach the turtle is clumsy and deliberate, but once in the water it moves fast and promptly rids itself of its rider.



Photograph by Otho Webb

TURTLE-RIDING IN BARRIER REEF WATERS

A game that requires a steady nerve and a bathing costume. Though a turtle can carry a person with ease, it is quite a feat to ride one after it has entered its natural sphere, for it moves swiftly.

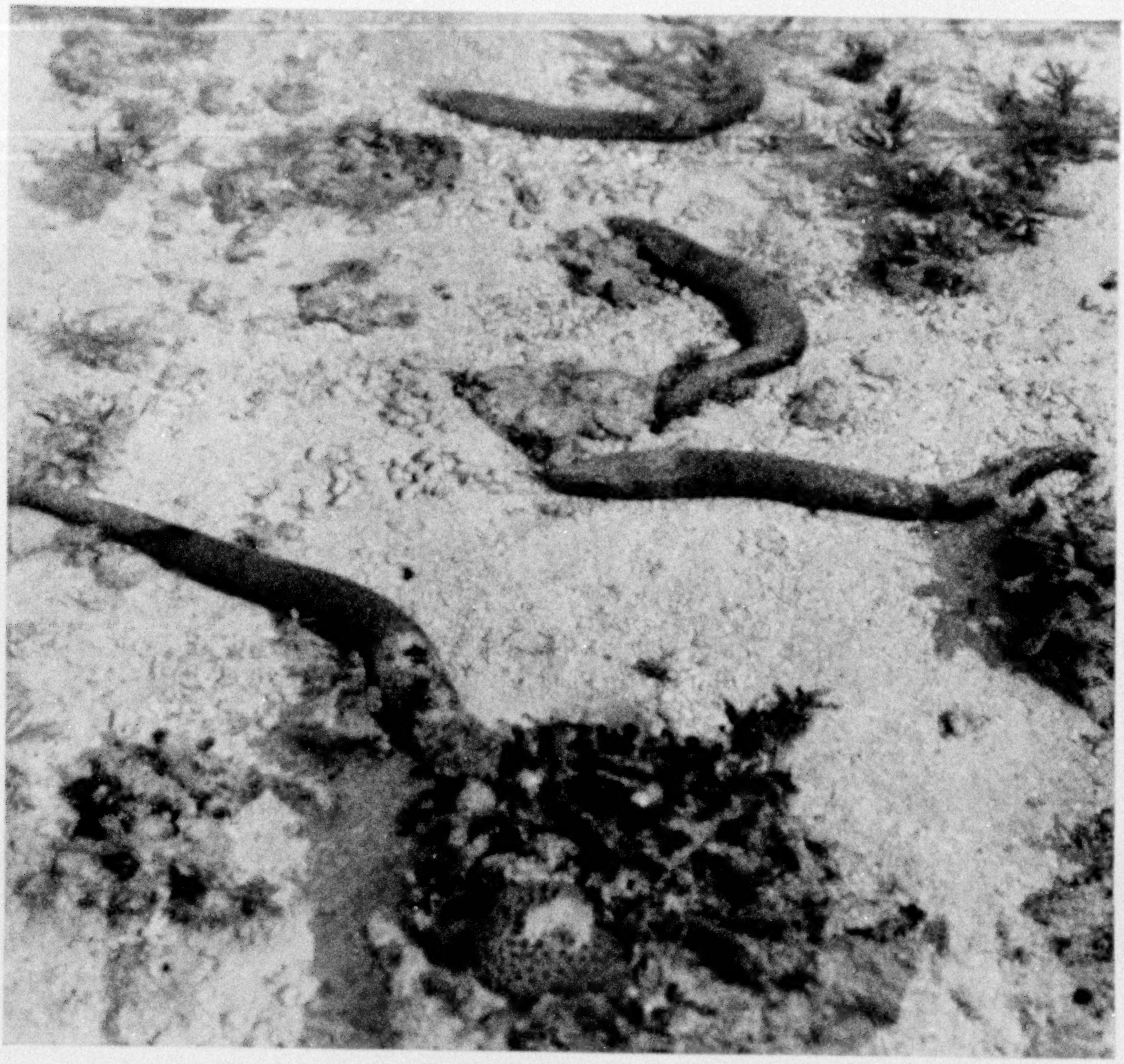
Thousands of folk who make the winter tour to Queensland from southern ports say they have been to the Great Barrier Reef, whereas they have merely sailed among the lofty islands, maybe without landing even on an atoll or a cay, the low coral isles beyond the high ones of granite. Only the few who go north venture to seek the actual Barrier, where that long line of thundering surf rises in mid-ocean.

There is charm in the Grand Canal trip, and life is pleasant on the favored islands, where a bungalow may nestle amid tropical fruit trees and palms, with a creek singing near on its little journey to the sea. Men have lived half a lifetime on a Barrier Reef isle without desire to wander. It may be a lotus-eating life, or one of healthy work and play, as you please.

Rich men and poor men are lured to the region. Beach combers are rare now, yet here and there one meets with the cheerful loafer, who takes to a task only at the urge of sheer necessity. They tell stories, up North, of the old colonial days, when the holiday tourist was a novelty and life was rough and ready all through the year, in ports and on the settled islands.

SPANISH TREASURE IN THE SEA

Romance among the reefs there is, and I have seen relics of the old-time voy-



Photograph by Otho Webb

THROUGH CRYSTAL-CLEAR WATER BÊCHES DE MER ARE PHOTOGRAPHED LYING ON THE FLOOR OF A LAGOON

Known also as trepang, sea cucumber, or sea slug, the bèche de mer crawls about on coral reefs. Black boys dive for the edible species at low tide, spear them from punts, or capture them by hand in shallow water. At the curing stations they are boiled for 20 minutes, slit, gutted, sun-dried, and smoked. The industry is an important one for Australia, for the Chinese buy quantities of them as a soup ingredient (see, also, text, page 380).

agers recovered from the sea. But sanguine treasure seekers, imagination fired by stories of lost galleons, were better employed seeking on "pirate islands" than among the coral of the Great Barrier. Coins *have* been found, Spanish ones, too; yet, in these waters, it is far more profitable to go pearl-fishing than diving for "fairy gold."

Spain, though, played her part in pioneer navigation of Australasian seas. In 1605 three ships under Admiral de Quiros sailed for the South Pacific from Callao. The captain of one was Luis Váes de Torres, whose name lives forever as that of the strait between Australia and New Guinea. His vessel became separated from the other two, and Torres was probably the first European to sight Cape York Peninsula, the northernmost point of Australia, and Prince of Wales Island.*

NATURALIST JUKES FIRST SCIENTIFIC INVESTIGATOR

But Torres's discovery was a secret from the world until 1762, when among the archives at Manila the record of his

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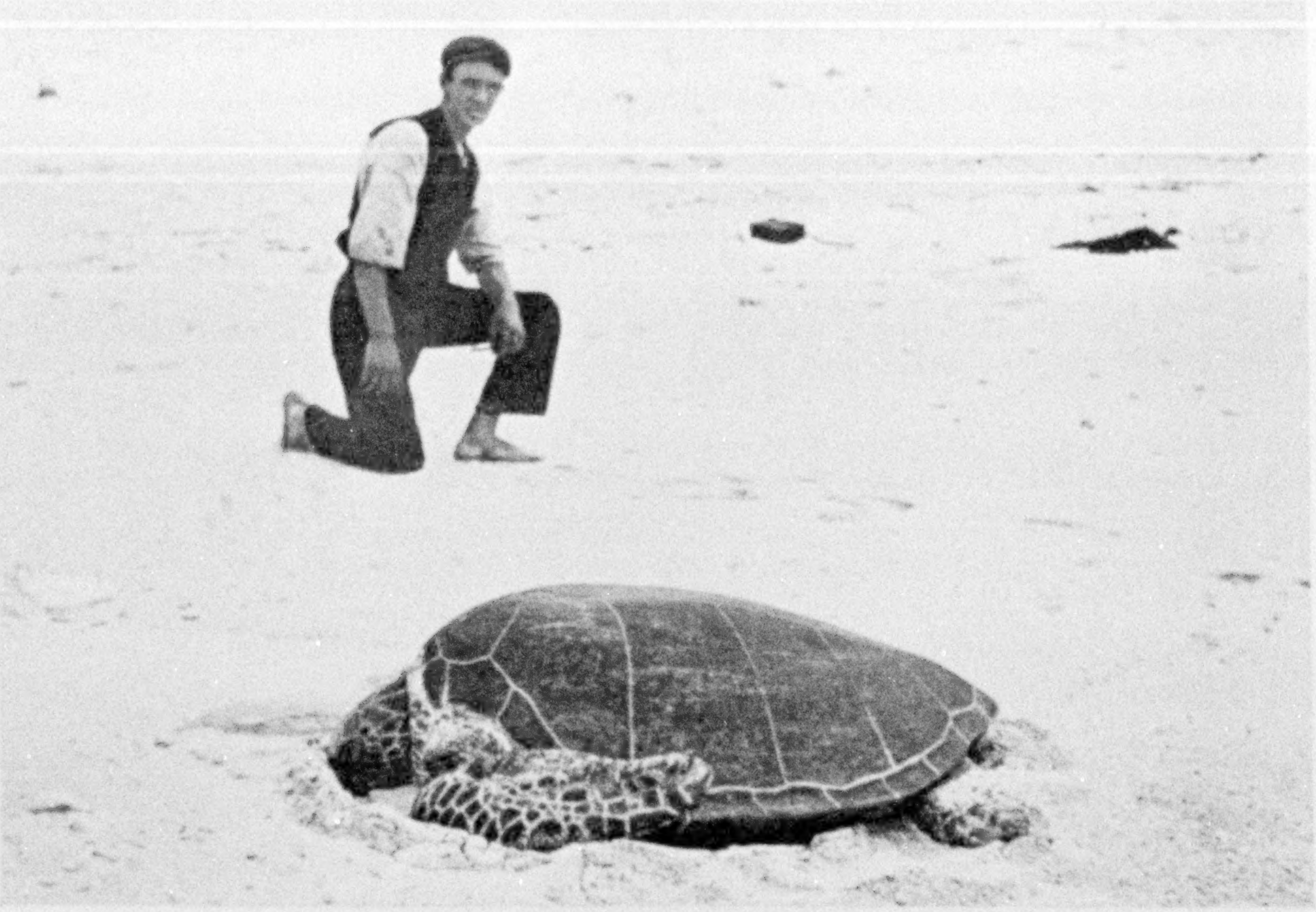
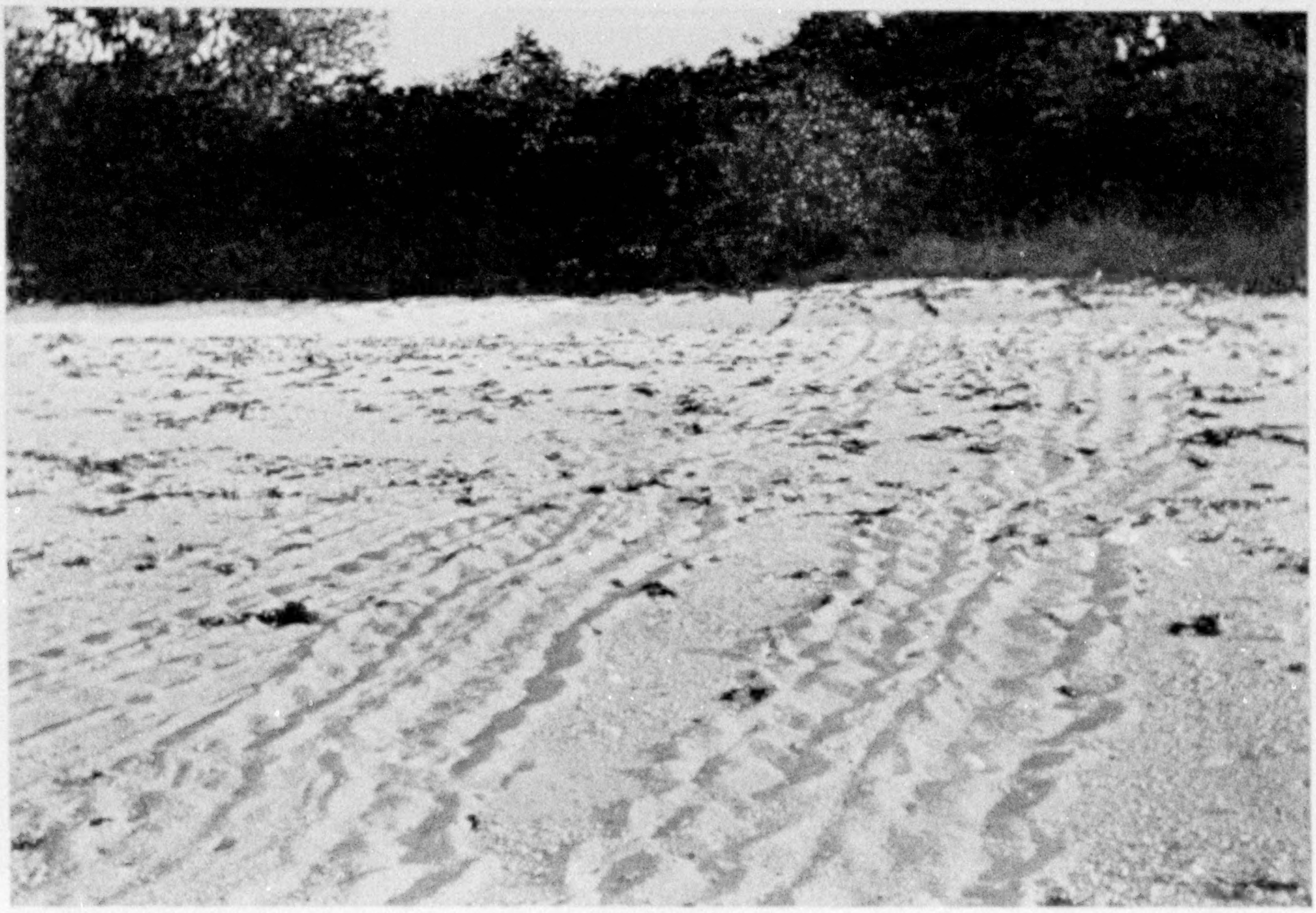
* See, also, "Geography and Some Explorers," by Joseph Conrad, in the NATIONAL GEOGRAPHIC MAGAZINE for March, 1924.



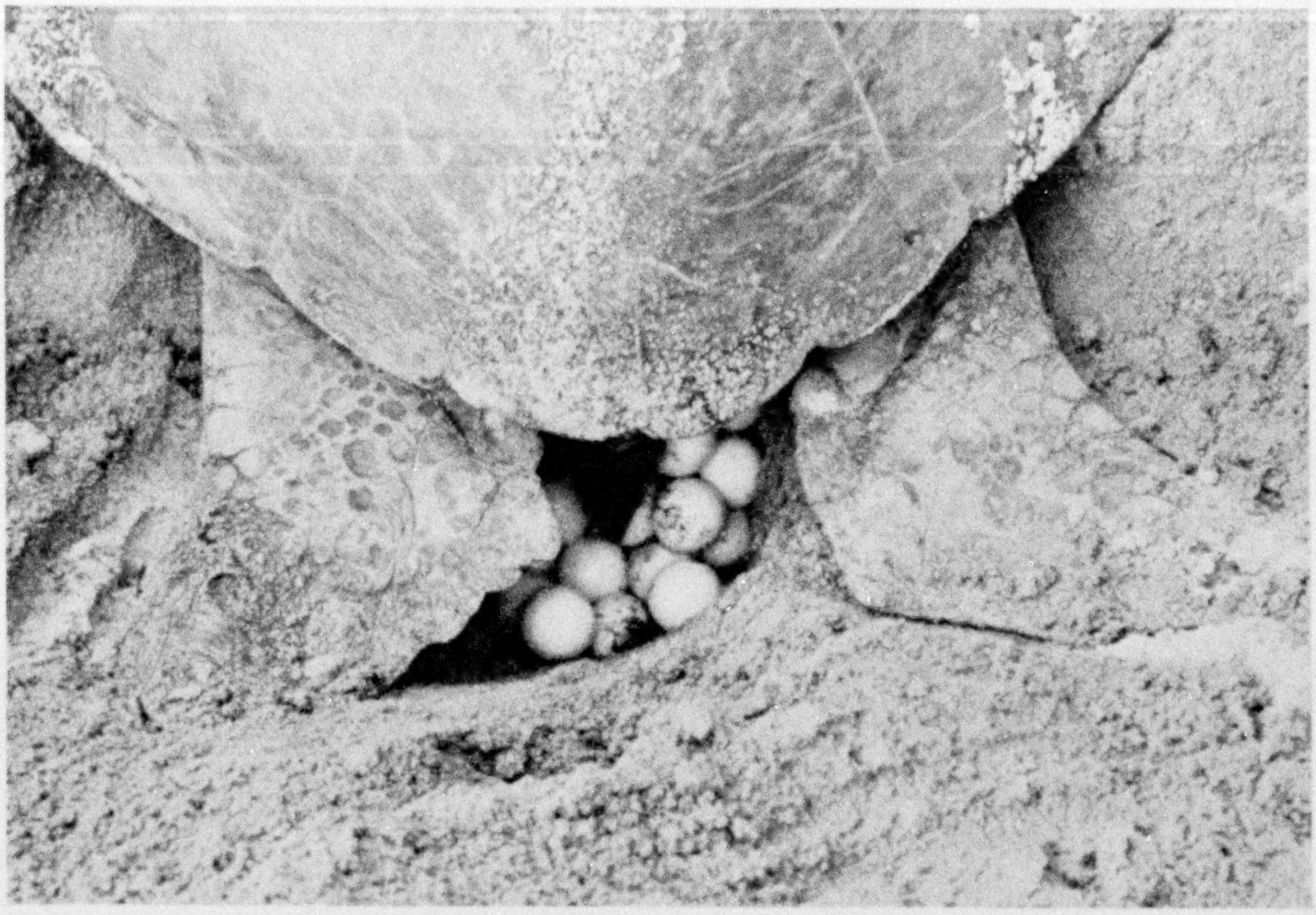
CAUGHT NAPPING ON A CORAL ISLAND BEACH



Photographs by Charles Barrett

TURTLE TRACKS ON A TROPICAL ISLE

Green turtles visiting islands of the Great Barrier region lay their eggs in big holes dug in the sand with their flippers. The heat of the sun hatches the eggs (see page 366). Broad tracks are furrowed from the waterside to the edge of vegetation by the lumbering sea creatures.



Photograph by Otho Webb

THE GREEN TURTLE LAYS FROM 100 TO NEARLY 200 EGGS

The eggs are round, white, soft-shelled, and smaller than billiard balls. Before she lays them, however, the female tries to mislead all enemies as to the location of the nest. She scoops out several pits during a visit to a favorite beach, but postpones laying until next day. Then she digs new pits, fills them partially, leaves others unfilled, and finally excavates still another nest, where the eggs are deposited and the hiding place smoothed over.

great voyage was found by the British. They gave honor where it was due, naming the strait after its discoverer.

Scientific investigation of the Great Barrier Reef began when H. M. S. *Fly* cruised in the Coral Sea and other waters.* Her voyage extended over several years, 1842-1846, and J. Beete Jukes was the naturalist on board her, a geologist whose interests were not confined to rocks. Jukes wrote the first description of the Great Barrier, which remains one of the best general accounts we have of this geographical wonder:

"The Great Barrier Reefs are thus found to form a long submarine buttress, or curtain, along the northeastern coast of Australia, rising in general precipitously from a very great depth, but resting towards the north on the shoaler ground of Torres Strait, and towards the south on the bank stretching off from Sandy Cape.

"If it were to be laid dry, this great Barrier would be found to have a considerable resemblance to a gigantic and irregular fortification, a steep glacis crowned with a broken parapet wall, and carried from one rising ground to another. The towerlike bastions, of projecting and detached reefs, would increase this resemblance."

Captain Cook's description of a coral reef, forgotten by all, perhaps, but readers of the great navigator's "Voyages," is worth quoting:

"A reef such as one speaks of here is Scarcely known in Europe. It is a Wall of Coral Rock rising almost perpendicularly out of the unfathomable Ocean, always overflown at high Water generally 7 or 8 feet, and dry in places at Low Water. The Large waves of the vast Ocean meeting with so sudden a resistance makes a most Terrible Surf breaking Mountains High . . ."

W. Saville-Kent, whose monograph on the Great Barrier Reef is notable for splendid illustrations, was Commissioner

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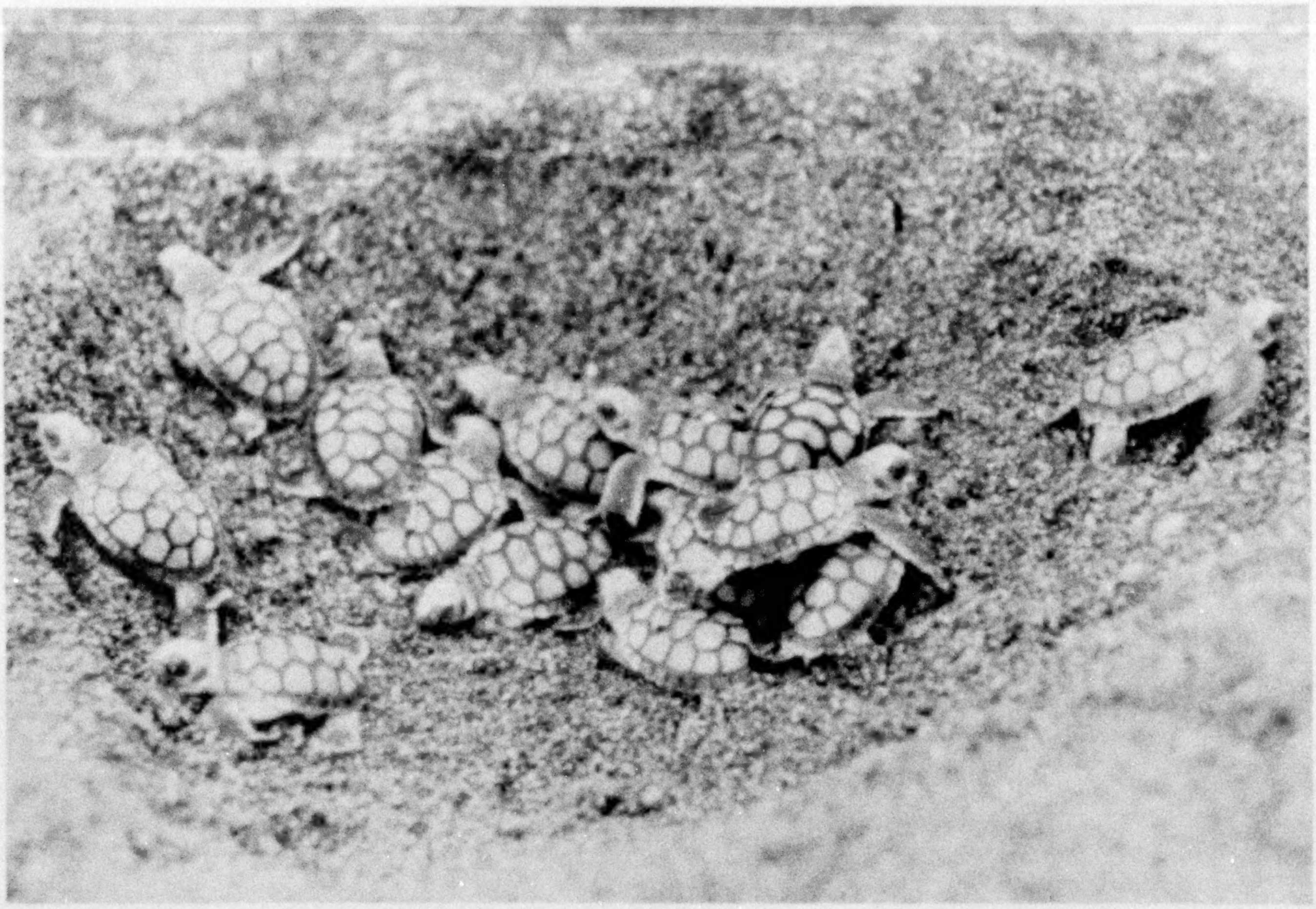
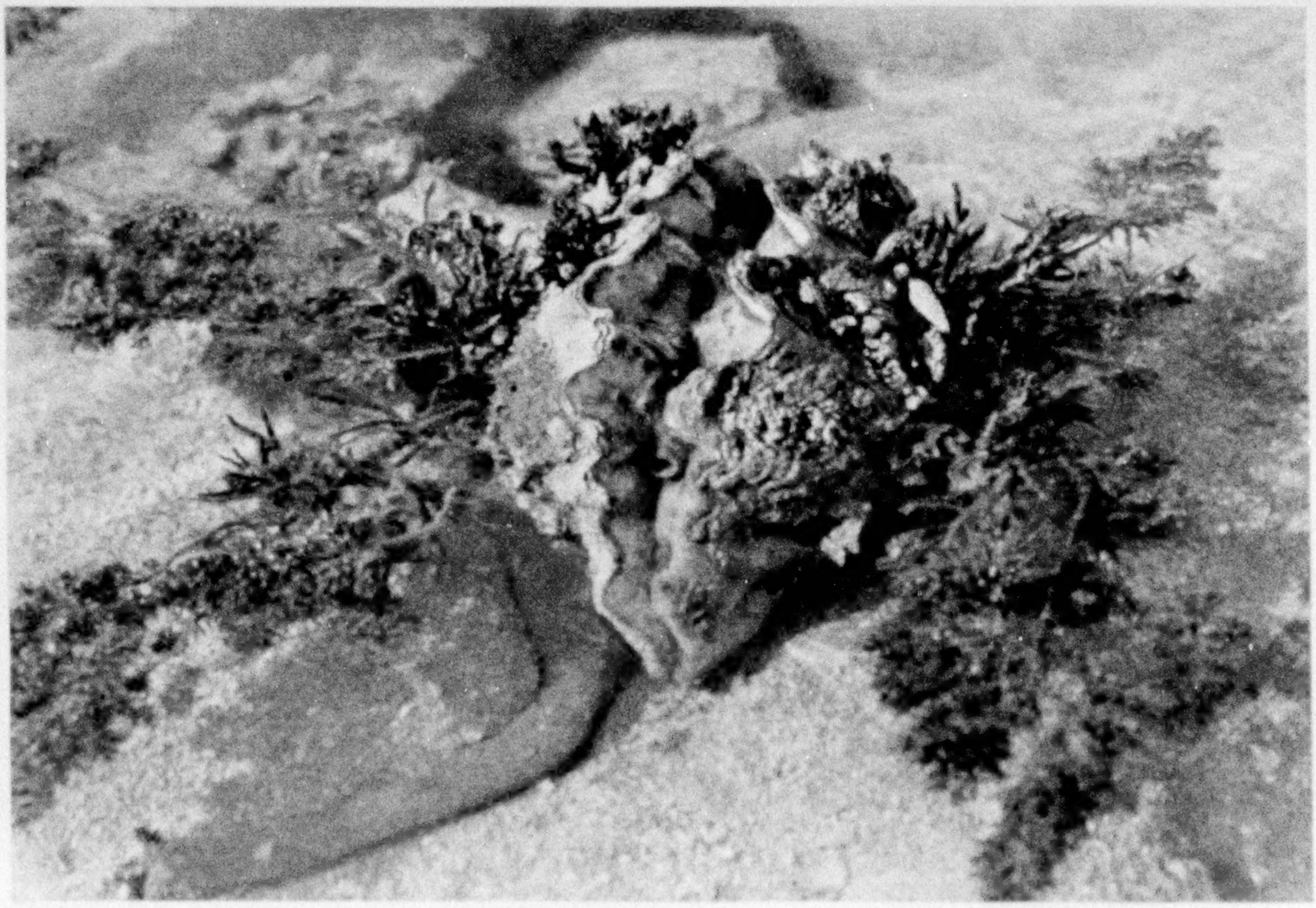
* See, also, "Into Primeval Papua by Seaplane," by E. W. Brandes, in the NATIONAL GEOGRAPHIC MAGAZINE for September, 1929.



GREEN TURTLE YOUNG THREE DAYS OLD

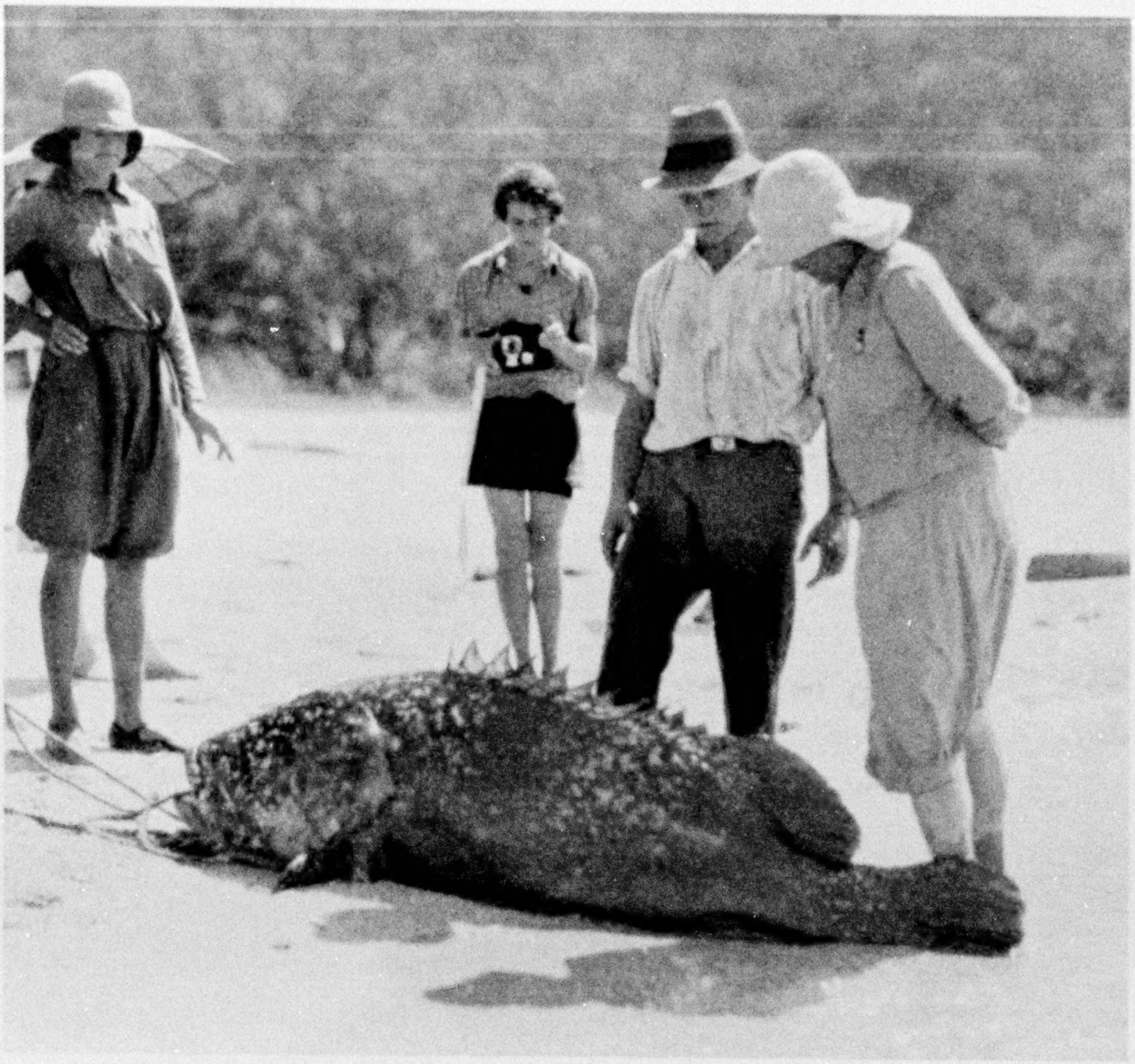
When hatched, they dig themselves out of the sand and start for the water.



Photographs by Otho Webb

HUGE CLAMS PROVE DANGEROUS TO THE UNWARY

Many species of marine animals are found along the Barrier Reef, some whose shells are large enough to form a pair of child's bathtubs. Two sea slugs may also be seen—one in the foreground, the other behind the shell.



Photograph by Otho Webb

A 260-POUND ROCK COD CAUGHT ON A HAND LINE

The pearl divers of the north are said to dread these giant fish far more than they do the sharks, which they consider cowardly and more easily frightened off. When he attacks, the cod is dogged and determined in his methods. He lies in wait among rocks and reefs, from which he rushes forth to seize his victim. "Rock cod" is the vernacular name for several fishes that have little relationship to the true cod.

of Fisheries for Queensland. He made an intensive study of fishes and other marine products, and has never been excelled as a photographer of corals *in situ*.

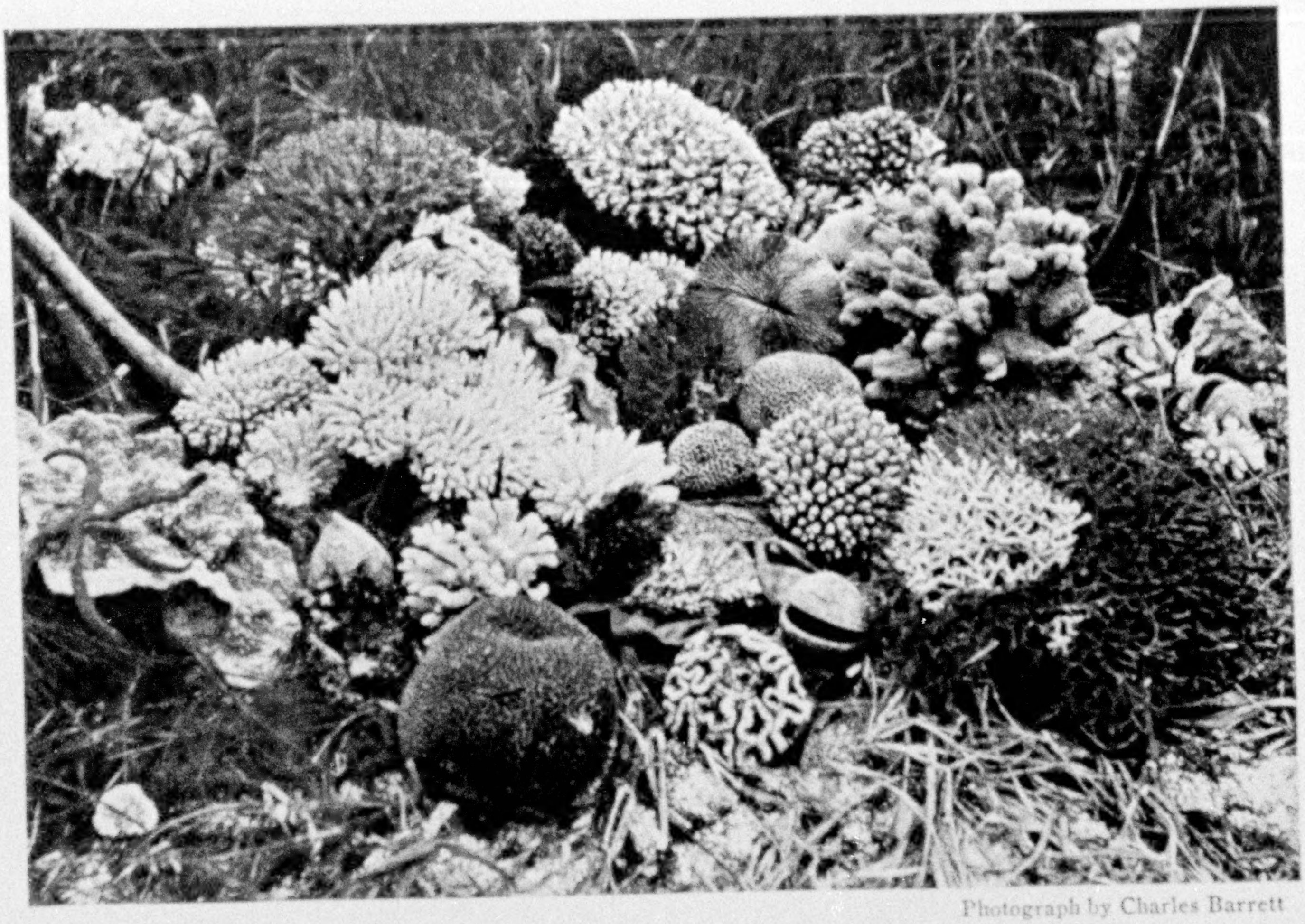
Alexander Agassiz visited the Great Barrier Reef in 1896, in the course of his survey of coral reefs generally. Other scientists followed. The latest and most extended expedition ended in July, 1929, when British scientists under the leadership of Dr. C. M. Yonge quitted Low Islets, their headquarters for a year.

MERMAIDS OF THE ISLE

These scientists, some from famous universities—Oxford and Cambridge and Edinburgh—were all young, keen, and capable. They landed on the tiny isle, enthusiastic and cheery as a band of holiday makers, and settled down to work immediately. Their enthusiasm never flagged, though often they were weary.

There were women among them. The leader and his first lieutenant, and the doctor who specialized in starfishes and their kin, were accompanied by their wives, and a girl from Scotland was the phytoplankton expert.

These young British ladies didn't come to Western Low Island, as one of them said crisply to a visitor, to "look pretty," but to share whatever was going, manual



Photograph by Charles Barrett

CORALS AND SHELLS THAT REWARDED AN HOUR'S RAMBLE ON MASTHEAD ISLET REEF

work as well as study. They helped carry heavy luggage from the launches to the huts; used saw, and chisel, and hammer; insisted on joining the water-fatigue; washed socks and shorts, and were "on duty" in the laboratory every working day.

The huts on Low Island were stoutly built of native timbers, from mainland forest originally. They were large enough and comfortable. Elaborate apparatus was brought to the coral island. The chemist's corner was a picture, with its array of bottles and tubes and balances. In a wooden hut on the isle that Captain Cook was the first white man to see, 20th-century science was at home, as in a museum laboratory (see page 372).

The lighthouse on Low Island, the western isle or islet of the "twins," whose beam has been for years a guide to mariners, had keepers who were ever willing helpers. They welcomed the invasion of their lonely flake of coral rock and sand, with its coconut trees and a few other trees and bushes—an isle around which one could ramble in less than half an hour and cross in two or three minutes.

"Andy," a Queensland aboriginal, was handy man; he did the chores for the busy naturalists. His wife was cook, his little daughter waited at table.

While the "home" reef was the hub of things, trips were made to other islands, far and near, and to the Outer Barrier. The expedition had launches in commission through the year, and for plankton collecting and sea-water sampling they were used freely.

A PERILOUS BOAT TRIP IN A DECEPTIVE SEA

"Summer isles of Eden" like gems on tranquil seas; the beauty of blue lagoons and graceful coco palms is not imaginary. But the smile of the sea may be deceptive, luring you, in a small craft, from shelter toward the outer reef, and changing to menace swiftly.

One boat trip I made with other naturalists in quest of a reef of the outer zone was perilous. We had less than ten miles of open water to cross from our snug little coral island, and we started serenely. Soon the launch was in heavy seas. And the reef we sought was elusive. Far to windward, finally, a line of breakers was seen; nearer, the light-green of shoal water.

Photograph by Charles Barrett

A MARINE ZOÖLOGIST SORTS HIS HARVEST FROM THE CORAL REEF

In the lee of the reef, white with raging surf, we lay to, waiting on the tide which should be ebbing. Homeward bound, hazy as to bearings, we sailed into a maze of coral. The helmsman needed all his wits, and the warnings of a man at the masthead and another at the prow. Perilous navigation it was, in shallow water thickly sown with hazard. We won through, dodging hidden dangers and following tortuous channels through the maze. Then out into the open, to meet the swinging seas again.

RIVAL THEORIES REVIEWED

Rival theories regarding the formation of coral reefs and islands have been warring against one another since Darwin's day. Subsidence, the simple and beautiful theory evolved by the author of "The Origin of Species," after years of eclipse is shining forth again.

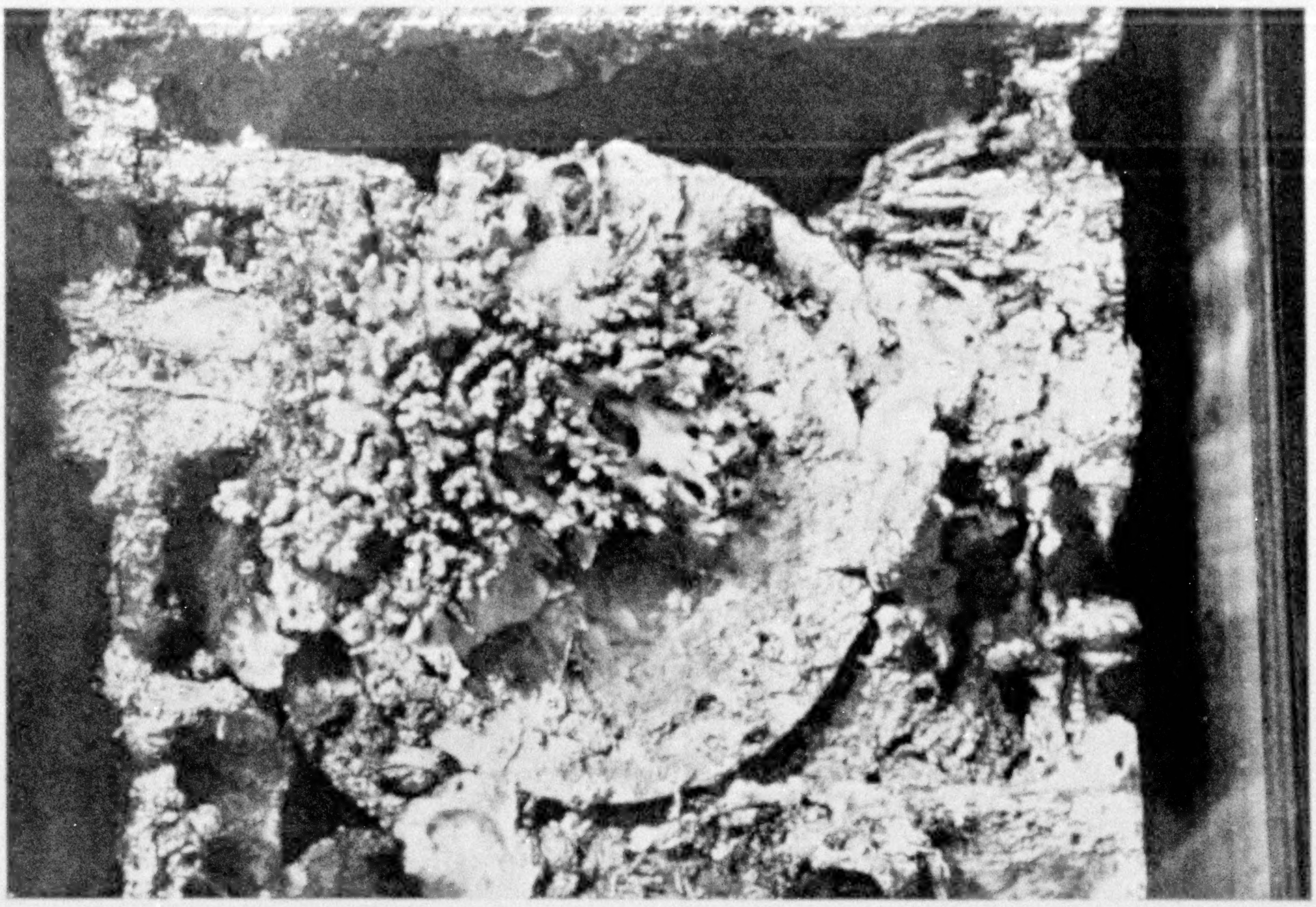
Subsidence, the "drowning" of land masses, as granite islands, and the upgrowth of coral from the slopes to the surface, offers a reasonable explanation for the existence of the Great Barrier. The weight of evidence seems at present in its favor. Notable among the other theories is that of submarine platforms on which Nature has reared the mighty structures known as coral reefs.

Apparently, reef-building corals are unable to flourish at a greater depth than about 40 fathoms. Many scientists have estimated the age and the thickness of the Great Barrier. Agassiz, among others, favored a thin veneer, but Jukes believed the reef to be of great thickness, and he accepted Darwin's as the true theory of coral reefs.

More than one authority has ascribed a Mesozoic age to the Great Barrier; others date its origin from the Tertiary; and Agassiz, from Cretaceous times. Then there is the glacial-control theory, which gives the Barrier a thickness of between 200 feet and 300 feet, and dates it from the Pleistocene. That atolls had their beginning as solid blocks, the interiors of which were dissolved by the "chemistry of the sea," is still another theory that has its champions.

BORING THROUGH THE BARRIER

Long ago a party of scientists spent three months on a coral island, Funafuti, a "dot" of the Ellice Group, about 70



Photograph by Capt. Frank Hurley

CORAL GROWTH ENCRUSTS A PORTHOLE

Six and three-quarter inches of coral have grown on this relic blasted from the British steamer *Quetta*, which struck Quetta Rock, southeast of Cape York, and foundered in 1890. The photograph is of special interest because it indicates the rapidity of growth of coral formations.

miles north of the Fiji Islands and some eight degrees south of the Equator. The object of the expedition was to test the correctness of Darwin's coral-atoll theory by putting down a diamond-drill bore 500 feet or more into an atoll to obtain a core of rock.

At a depth of 698 feet boring was ended on account of a serious breakdown of the machinery. Subsequent boring exceeded 1,100 feet. Valuable material was gained for study, but the origin of atolls was not disclosed beyond doubt. We have still to weigh conflicting evidence, and vote for Darwin or for one of the rival theorists.

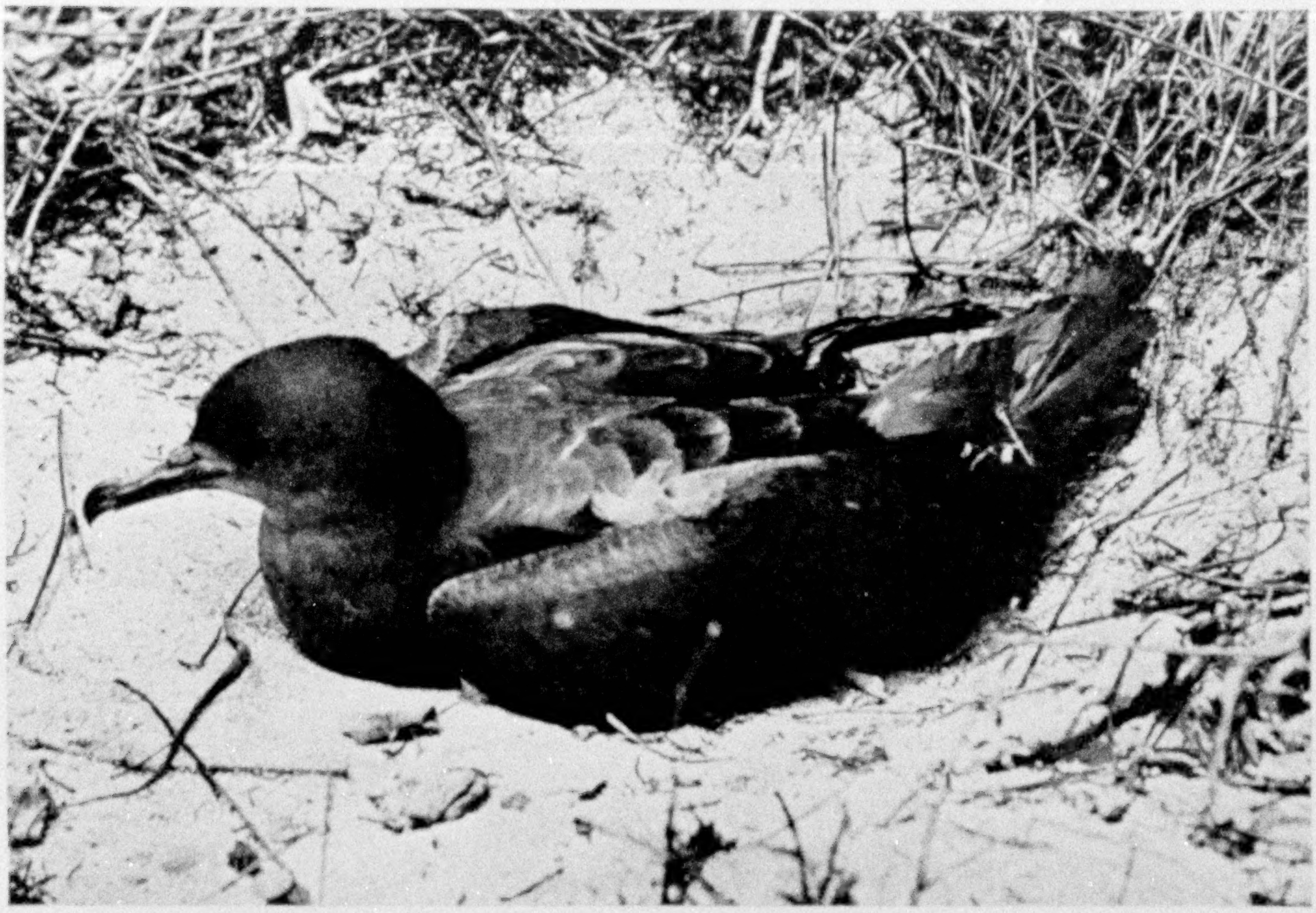
Another boring venture was undertaken, this time by the Great Barrier Reef Committee, which selected for operations a coral sand cay on Michaelmas Reef, within easy distance of Cairns, the popular holiday resort on the north coast of Queensland. My friend, Charles Hedley, Scientific Director for the Committee, had charge of the boring operations, carried out under many difficulties.

The object of the bore was "to obtain quantitative information as to the thickness and nature of the coralline deposit, and, further, to determine the character of the foundation on which the coralline mass was built."

The depth reached was 600 feet. Beginning with coral dune sand of the beach, passing through solid coral (porites) from 12 feet to 19 feet, and various other "formations," the bore ended in gray-green calcareous glauconite ooze. Coralline material, except for a few feet of solid coral, was loosely coherent and extended to a depth of nearly 430 feet. Beneath this, the report records (apart from a little coral sand), to the depth of 600 feet, there were only rounded quartz sand with abundant foraminifera and shell fragments, and much of the glauconite material.

AMONG THE CAPRICORNS

The evidence from the boring indicates that the coral mass is youthful, and that subsidence in the area has been consider-



Photograph by Charles Barrett

SHEARWATERS NEST IN MILLIONS IN AUSTRALIA

There are "mutton-bird islands" to the south of the continent as well as in the Great Barrier region

able. Other bores, as funds become available, are likely to be put down, perhaps on one of the Capricorn Islands.

I camped with other naturalists on Masthead Islet, of the Capricorn Group, one summer for a while. We visited the other islands, all uninhabited and lacking fresh water, apart from rainwater stored in tanks on one frequented by turtle hunters. We studied sea-bird life and the turtles, went reef-combing and gathered a rich harvest for science.

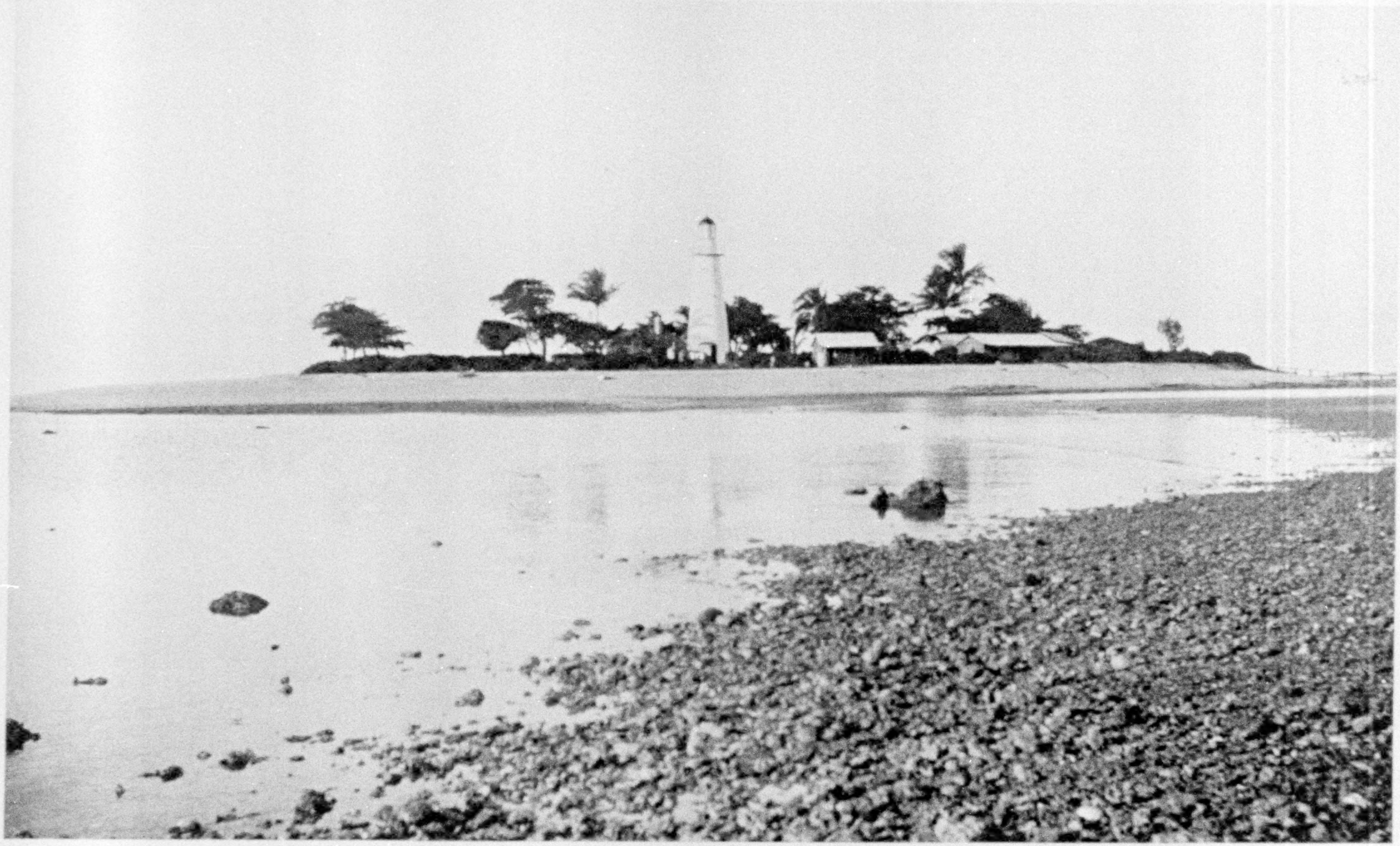
Lying at the southern extremity of the Great Barrier Reef, from which they are separated by a channel, the Capricorn Group consists of pseudo-atolls. Large vessels cannot safely approach the fringing reef, and we had a long row in the boat over the coral at flood tide from our ship to the shore.

A tropical rainstorm burst before our tents were up and the stores under cover. Nature gave us a drenching, but failed to dampen our spirits. We were as happy as holiday-makers on this coral island, which, as we neared it in our craft, had seemed nothing but a long gray shadow on the sea.

Masthead is the westernmost of a chain of reefs, extending for 54 miles, and all of the Capricorns are grouped about the Tropic which gives them their name. At low tide, we could ramble from camp over causeways of coral, an oblong reef about four miles from east to west and a mile and a half across, its crest perhaps a dozen feet above sea level. At high water Masthead shrunk to a sand bank about 100 acres in extent, placed near the western end of the reef and densely vegetated. It lacks a lagoonlet and is raised only a few feet above the sea.

The reef crest is "one long, unbroken sepulchre of actinozoan life" (Hedley). But what living wonders we found among the coral, in the shallow lagoon, and the causeway channels—wherever we looked, indeed!

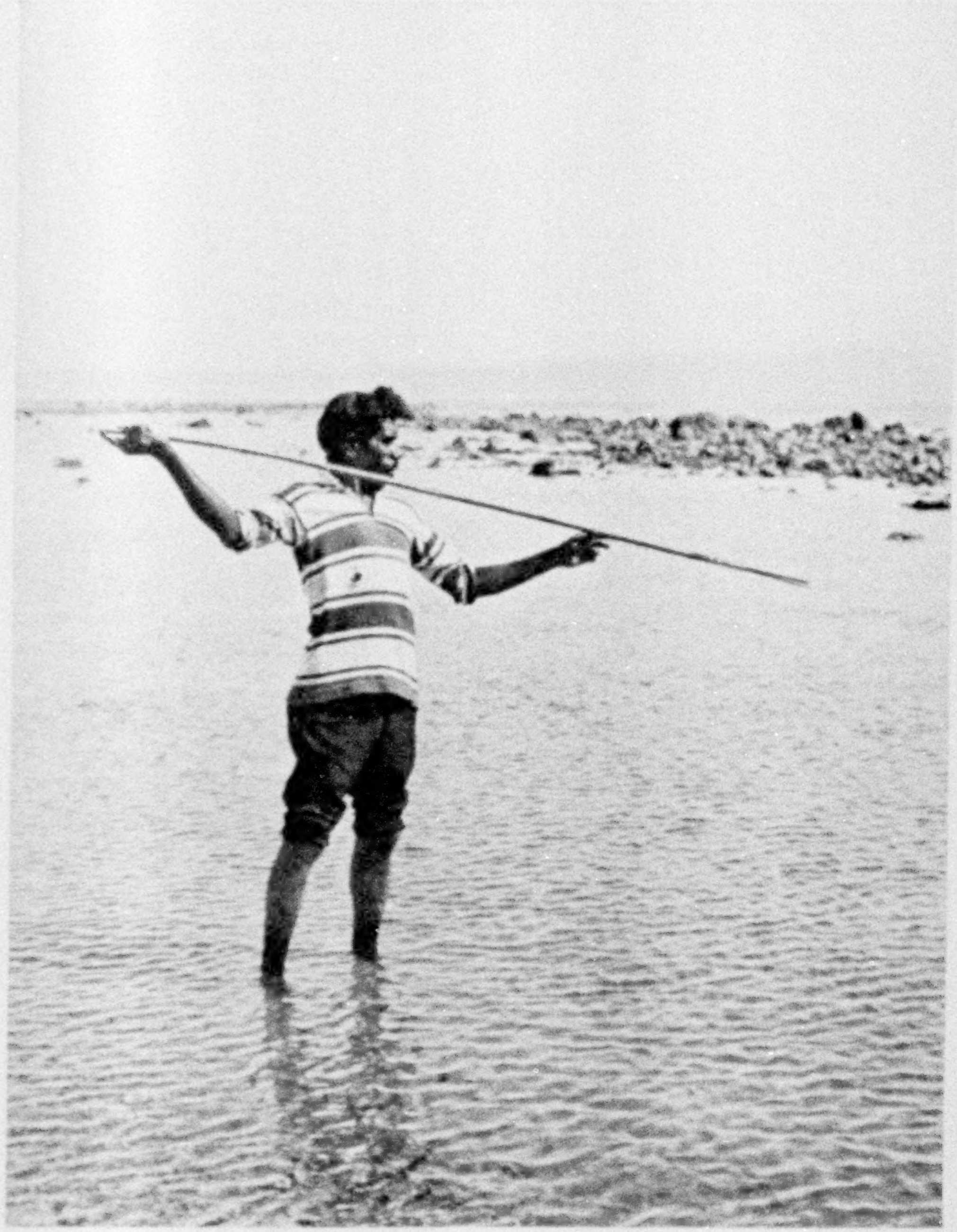
Now, Masthead is subject to the action of racing tides, with a range of 15 feet. At a speed of two knots the sea moves over the reef, and tides are "the chief

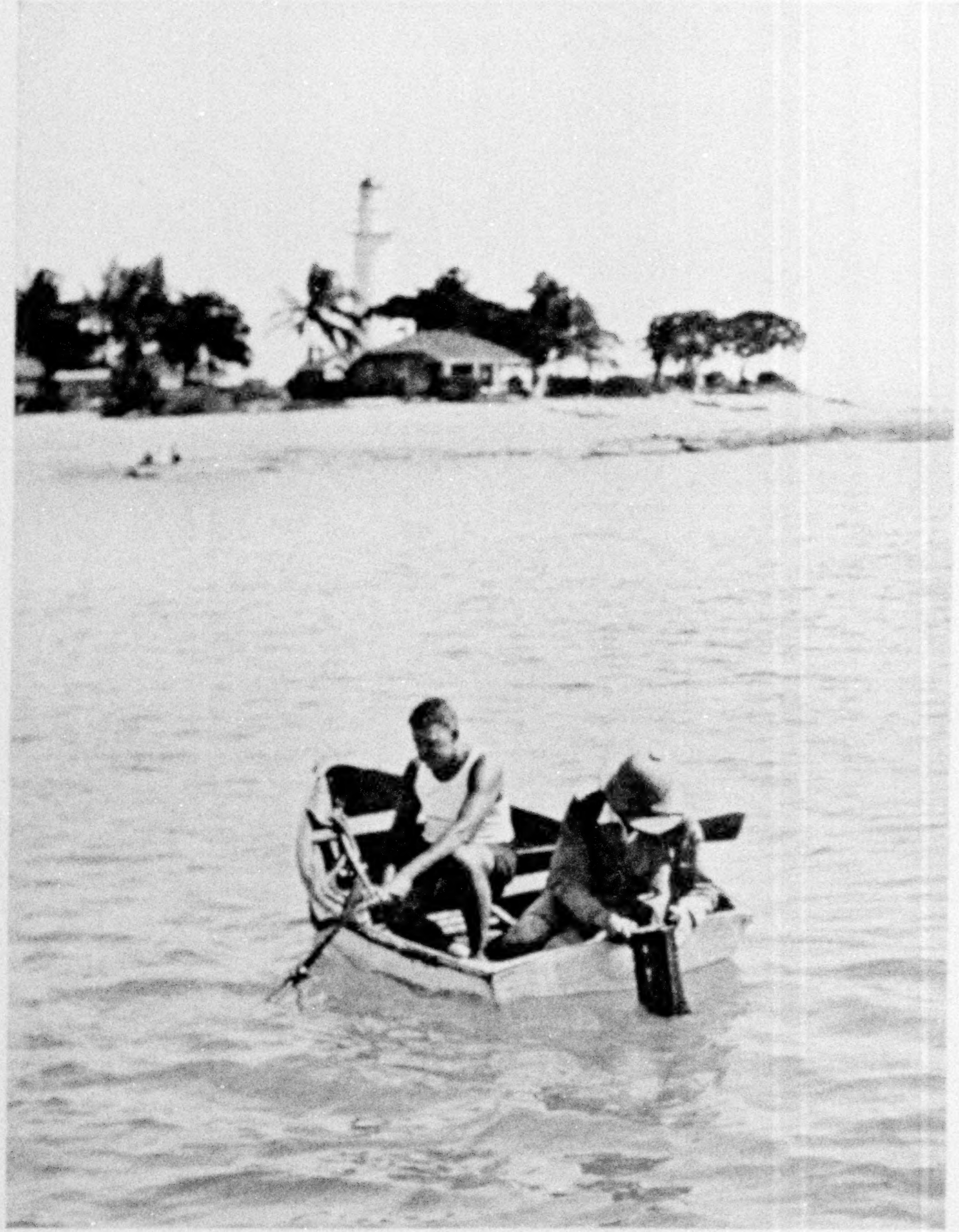


Photograph by Charles Barrett

CAPTAIN COOK'S FIRST CORAL ISLAND

Western Low Island (or islet), on which the British Great Barrier Reef Expedition had its headquarters for a year of intensive study. The expedition's huts are to the right of the lighthouse (see, also, text, pages 367-8).

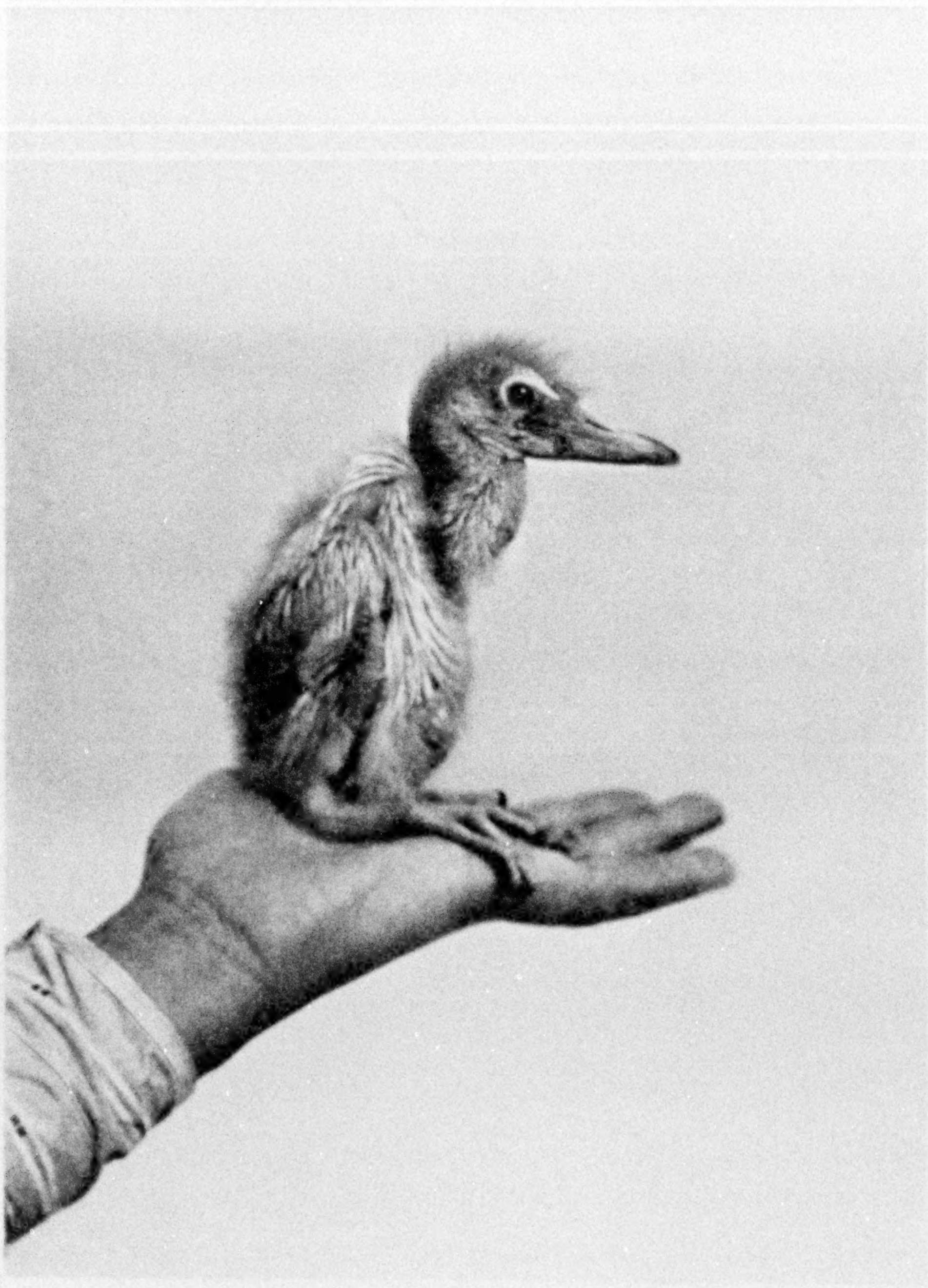




Photographs by Charles Barrett

THE ABORIGINAL OF TO-DAY FISHES WITH A THREE-PRONGED SPEAR, AS DID HIS FOREFATHERS

THE WATER TELESCOPE REVEALS BEAUTIES OF SUBMARINE GARDENS FAR BELOW



Photograph by Charles Barrett

THE REEF HERON'S BABY MAKES NO CLAIM TO BEAUTY

His nest is found on coral islands whose reefs provide feeding grounds for the parent birds at low tide.

agents of island building" in this group beyond the hurricane zone.

Far out on the reef, sometimes we forgot to watch for the turn of the tide. And racing the ebb over coral is apt to be painful! Delay means danger. Yet the spell of beauty—coral "flowers" and creatures of the pools—made us loath to hurry beachward when the flood was making.

A landing party for a sister isle of Masthead left the ship at half-flood and the boat struck coral nearly a mile from shore. The passengers, including three ladies, had to wade up to their armpits through swirling water to the island beach. The tide was rushing over the reef, and sometimes swept the waders off their feet. Large sharks swam near, and great turtles passed by at top speed. It was jolly to be on the beach at last, to bask in tropical sunlight and drink deeply of "billy" tea.

TRACKING THE TURTLES

"Turtle Island" is a nickname for Masthead, and surely is well deserved, for green turtles swarmed in the surrounding sea. They attain a length of five feet or more, and are famous as the "raw material" of turtle soup, while their flesh also is eaten in the form of steaks or in stews.

The green turtle is not confined to Australia, but is distributed over the tropical and subtropical seas generally, being ever-present in the Gulf Stream areas about Florida and Cuba especially. It visits the northwestern and northeastern coasts of Australia in the breeding season, depositing its eggs at night in deep holes in the sand on certain islands.

Masthead is a favorite resort of these huge chelonians. We counted nearly 300 one morning along the western beach, and many nests were found on the edge of the scrub.

In the moonlight, peering from cover, we saw the nursery-making. With their powerful hind flippers, the turtles excavated briskly. The eggs, in surprising numbers, were laid quickly; then sand was shoveled over them and smoothed down. Her task accomplished, back went the old lady to the sea.

In nesting time the hunters take toll of green turtles, which usually are captured when retreating from island beaches to the ocean. The luckless creatures are turned over on their backs and thus rendered helpless.

De Rougemont's exploits were remembered, and we tried turtle rides, with less success, but more fun perhaps, than Louis enjoyed, according to his famous story. Our rides were brief and exciting. We crept upon sleeping turtles and made seats of their carapaces. Thus surprised, they scrambled over the sand, plowing quaint furrows with their flippers, and gained the lagoon. Once in fairly deep water, the turtle won the game. A dive unseated the rider, who splashed ashore for another little joyride to the sea.

The united strength of three men was needed often to overturn a turtle caught napping on the sand. Grasping flippers and tail and the edge of the shield, we gave a sharp heave, and our friend was lying helpless on its back. The Turtle Derby of Masthead Islet was a memorable event! The jockeys wore bathing suits, and the "winning post" was just the sunlit sea (see pages 361-2).

A turtle-soup factory, established on one of the coral isles many years ago, still carries on business. During a recent season 36,000 tins of soup, representing about 1,000 turtles, were manufactured in this lonely place. How many of those who enjoyed the soup at banquets or private dinner-tables thought of atoll and lagoon, white beaches, and the hunters of chelonians?

Photograph by Charles Barrett

READY FOR THE CABINET

Bleached by the sun, corals of all kinds form desirable souvenirs of days on a tropical island.

Giant fishes inhabit these waters where the sea flows through deep channels. Groupers and snappers, and other big game fishes provide sport that already is luring Australian anglers and their brothers from other countries as well.

THE SEA BIRDS' REALM

Sea birds of the Great Barrier Reef include shearwaters, gannets (three species), the lesser frigate bird, the red-tailed tropic bird, and several kinds of terns. They congregate on islands of the outer zone and the coral sand banks in nesting time, and form great colonies.

Bird islands of Peru are not more wonderful than certain coral isles and cays of

Photograph by Charles Barrett

ON ISLANDS AND CORAL CAYS TERNS NEST IN LARGE COLONIES

the Great Barrier region. Vast numbers of eggs are collected by aboriginal islanders from the far north, by Japanese trepang and pearl-shell fishers, and other raiders of the rookeries. The Japanese, especially, harvest eggs as "free" food for their aboriginal crews.

Terns' eggs have been taken in boatloads from Bramble Cay and other noted haunts of these birds.

Among the Capricorns, white-capped noddies nest in thousands every year. On Masthead we estimated the bird population at nearly 100,000. The noddies, perhaps 20,000 pairs, were nesting in the pisonia trees; primitive platform-nests, made chiefly of dead leaves, each containing one egg only, and no two eggs of the hundreds examined were exactly alike in their markings. Of shearwaters, or mutton birds, there were some 30,000, nesting in burrows among the pisonias, and filling the night with weird sounds.

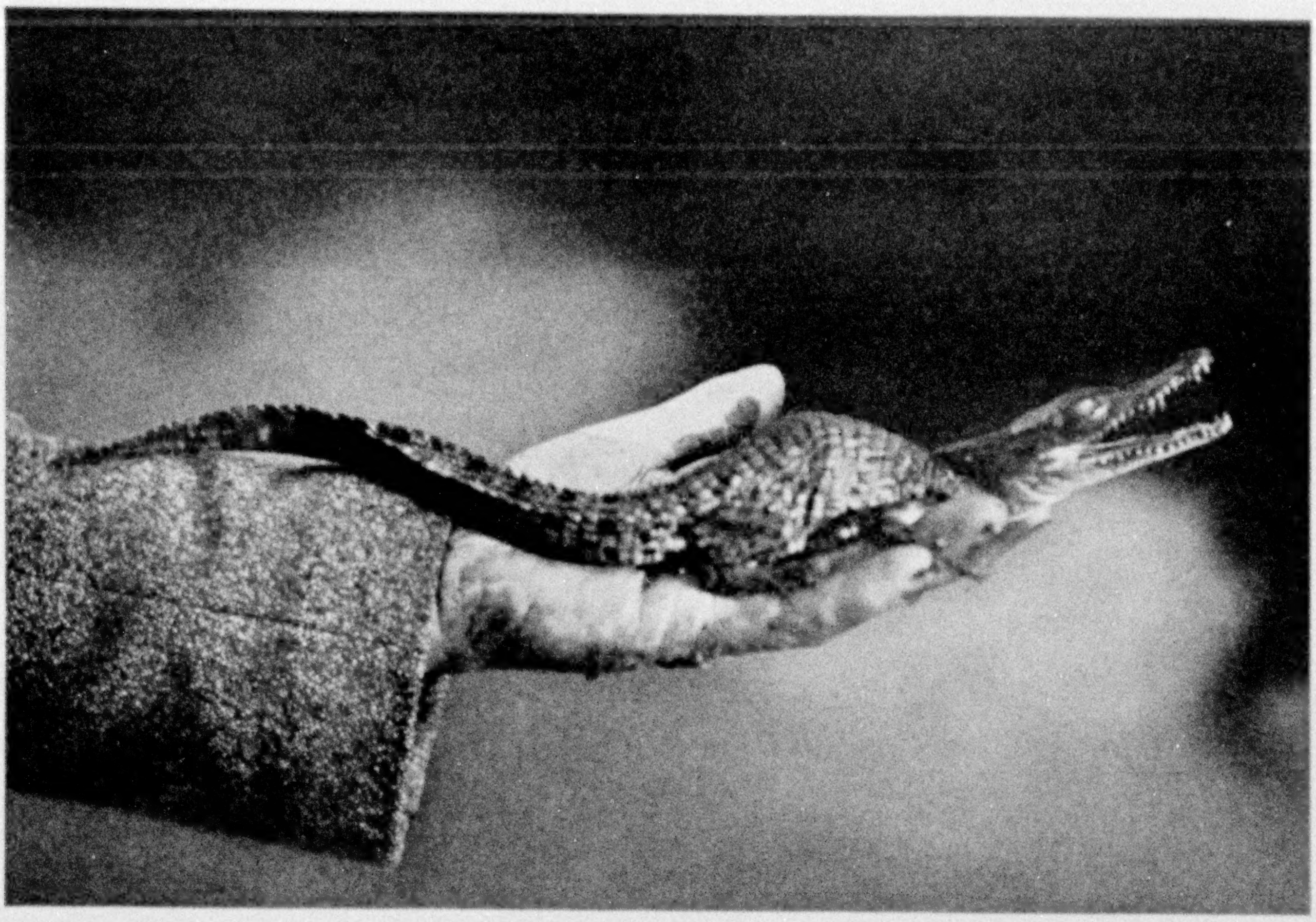
As a community, the noddies had regular times of sea and land faring, though hundreds at any hour could be seen on the wing. At dawn a host of graceful birds flew out to sea; about sundown the winged fishers returned. We watched them, never tiring of their beauty, as they flew over land or sea like a legion of big butterflies. At noon, in thousands, they were clustered on pisonia boughs, like tropic fruits strangely formed.

So tame were the noddies that often an egg could be examined only by pushing aside the owner; and the tern, or sea swallow, would peck boldly with her long, delicate bill at an intruding hand.

Shearwaters every night groaned and grumbled in their burrow, but it was little that we saw of the birds. Our cook, however, made a capture. He yelled at midnight, "I've got one!" Only, the bird, blundering into the tent, first had "got" *him*. Cook learned that mutton birds, as short-tailed shearwaters are known, can bite!

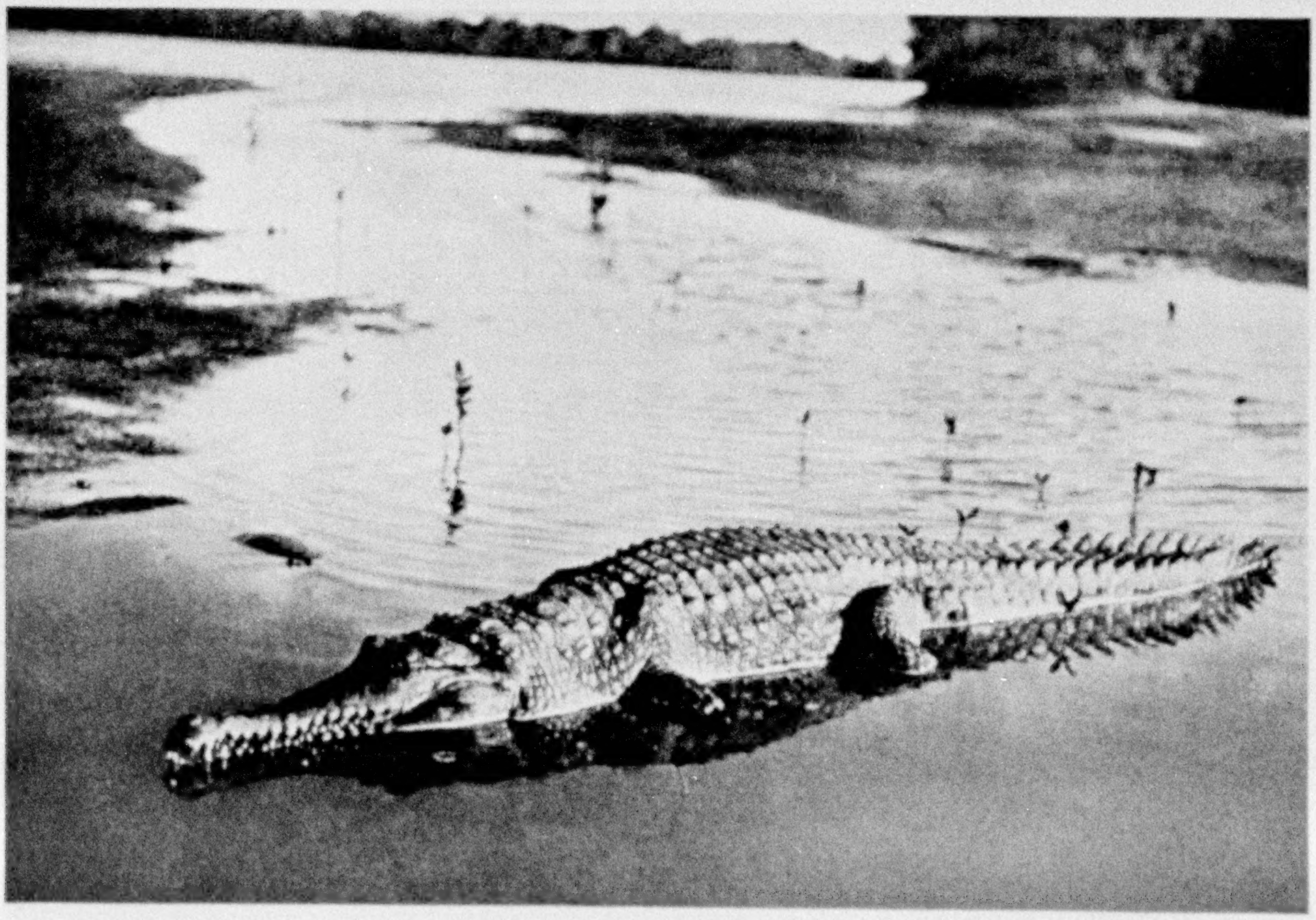
EACH ISLAND RULED BY A PAIR OF EAGLES

Sea eagles are familiar birds of the Great Barrier region. Each island of the Capricorn Group I visited was the territory of a pair of eagles; on each was an eyrie—one only, built high in a pisonia, or on a large bush with thick and woody stems. These nurseries were huge piles of sticks and boughs, with an unsavory "apartment" at the top for the young.



Photograph by Charles Barrett

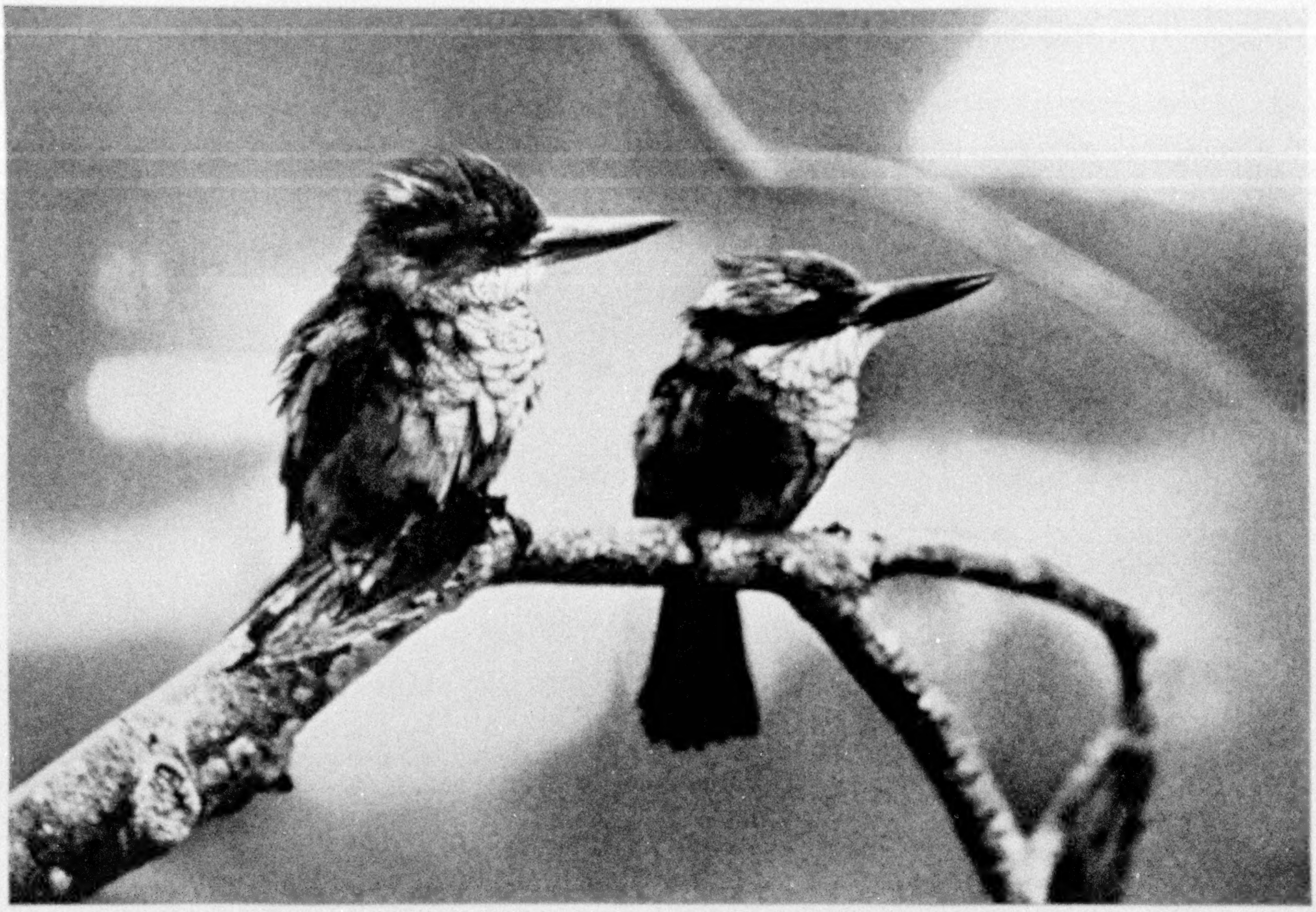
A BABY CROCODILE



© F. Birtles

CROCODILUS JOHNSTONI GROWS TO SEVEN OR EIGHT FEET IN LENGTH

There are two species of crocodiles in northern Queensland: the huge seagoing variety, which has taken toll of human life, and this smaller species that frequents only inland waters.



Photograph by Charles Barrett

FRIENDLY ISLANDERS

These kingfishers on an isle of the Capricorn group were "camp followers" of a party of naturalists. They nested close to the cook's quarters.

Sea snakes are plentiful in these waters, and the eagles prey upon them. Beneath the nests reptile remains are strewn, mingled with those of sea swallows and fishes from the blue lagoon.

Reef herons abound among the Capricorns, nesting in bushes, or choosing for home sites the stilt roots of pandanus, a species of screw palm that grows along the beaches above highwater mark. There are two color varieties of this heron, one slaty blue, the other white, like an egret. They are not distinct forms, because in the same nest one finds, not rarely, one white and two blue chicks, or two blues and a white one—three being the usual number in a brood.

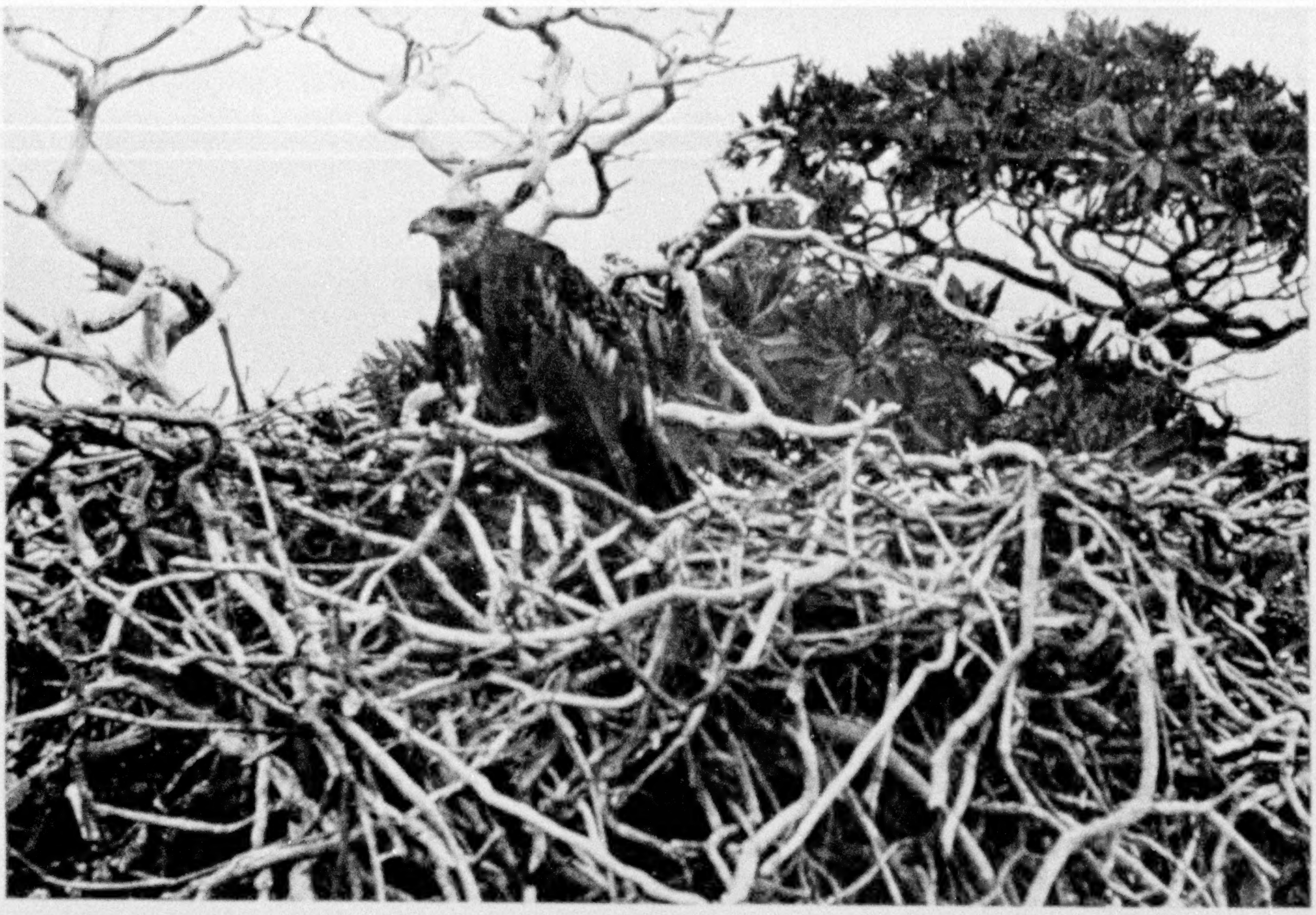
Some light-keepers are bird lovers, and at North Reef I found the herons so confiding that close-up photographs were possible. But the gulls, the dainty silver gulls which nested on the fringe of vegetation, were suspicious.

Oyster catchers ran about the coral strand, and nimble-footed dotterels twinkled to and from the shallows and hightide zone. Where the sand-binding marram-grass grew we located nests of both oyster catcher and dotterel. Kingfishers were visitors from the mainland. One pair came about our camp on Masthead Islet, perching together every morning on a pisonia bough. They were friendly birds, and reared a brood within sight of the cook's headquarters!

CORALS AND SHELLS

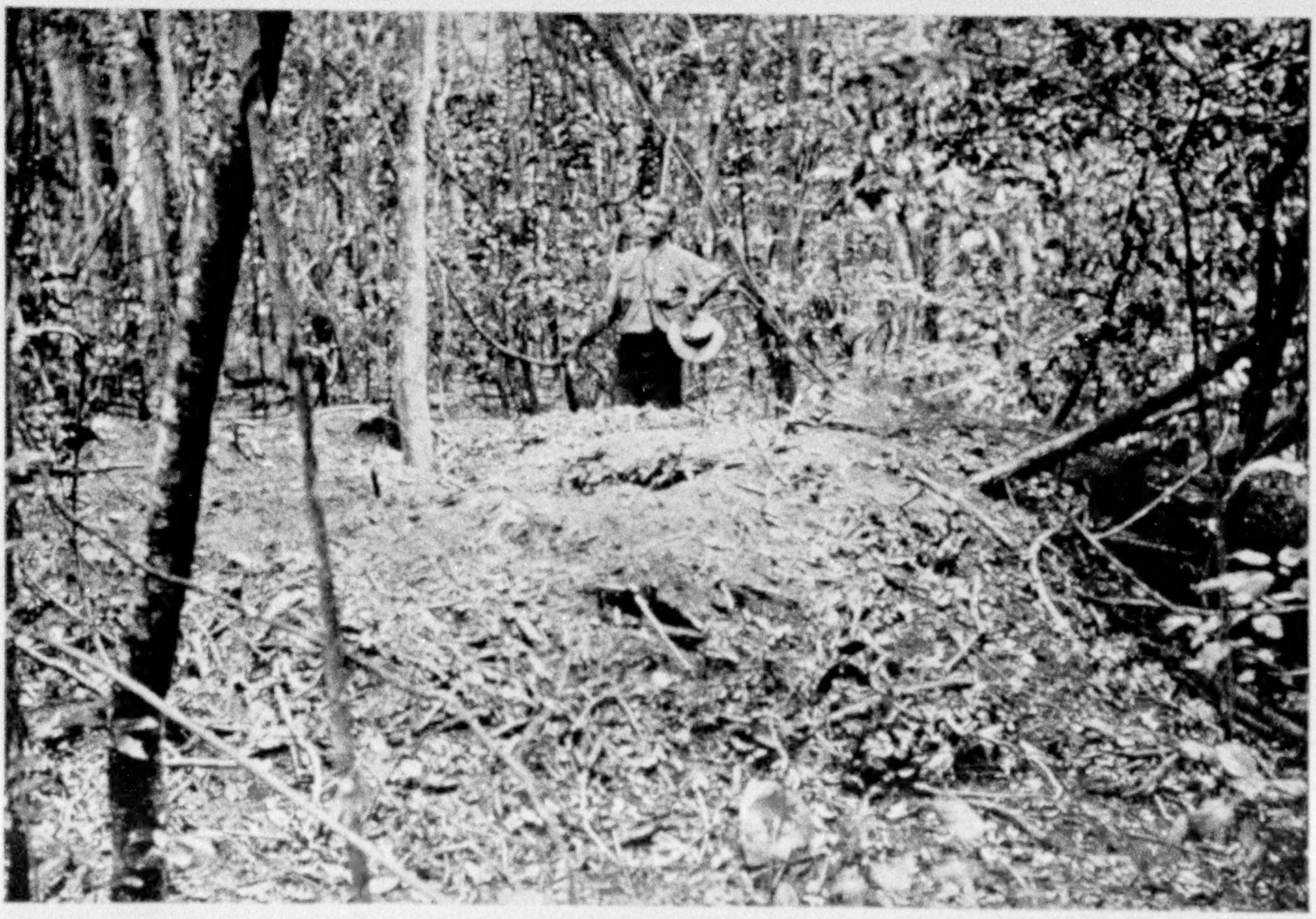
Combing the reef for shells is a delightful recreation. A conchologist might be content to spend a lifetime collecting and studying the mollusca of the Great Barrier Reef. It is rich in lovely species, and quaint ones. Money cowries are to be gathered by the pailful. Tiger, brown-shelled, egg, and others of the cowrie family occur among the coral.

Half submerged in sand in the lagoon are melon, or bailer, shells, the first name suggested by the shape and the color of the shell which, empty, serves well enough for bailing out a dinghy. Soup is made from the flesh of the melo animal, and is said to be savory. Melo is a remarkable mollusk, and its chambered egg capsule is



SEA EAGLES NEST ON ISLES OF THE GREAT BARRIER REEF

The eyries are huge structures of sticks. Deadly sea snakes form a portion of the food upon which the eaglets are reared.

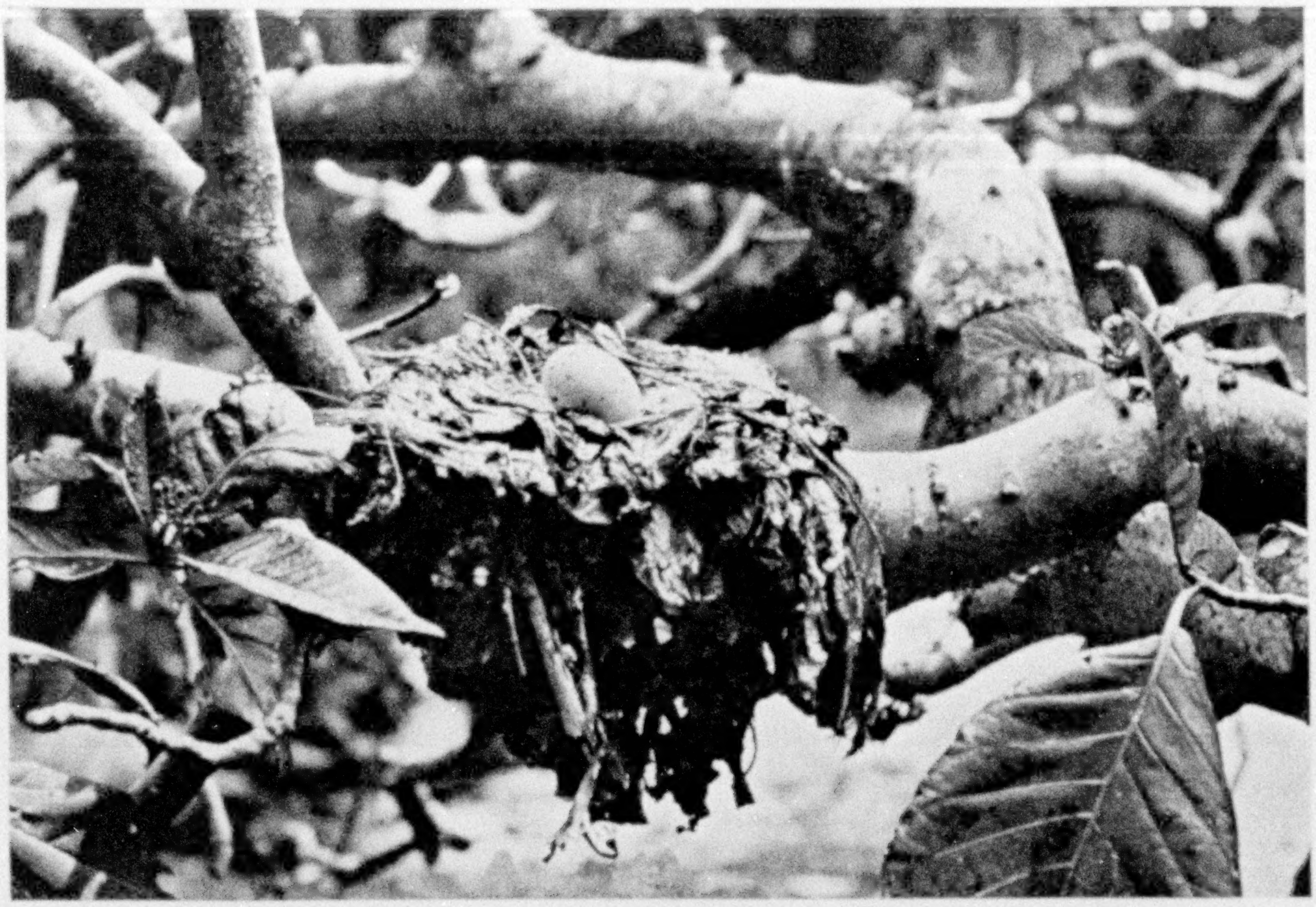


Photographs by Charles Barrett

THE WORK OF MOUND-BUILDING BIRDS OF AUSTRALIA

Huge piles of leaf mold and sand are heaped up with a hotbed of decaying vegetation in the center. The large eggs are deposited in the "incubator," and, when hatched, the chicks work their way to the surface.

XUM



Photograph by Charles Barrett

THE NURSERY OF THE NODDY

Among the isles of the Capricorn Group, white-capped noddies nest in thousands. The nests are formed of dead pisonia leaves, mingled with seaweed in some cases. An egg to a nest is the rule, and no two eggs in a colony are identical in their markings.

among the marvels of the coral realm. Each infant melo has a chamber to itself in the "nursery."

Spider shells, with spines that resemble crooked fingers, abound in shallow water. They are whelks that do not "walk," or crawl, but leap along the bottom. The animal is curious in appearance as well as in its habits. The operculum, highly modified, is used as a stabbing weapon.

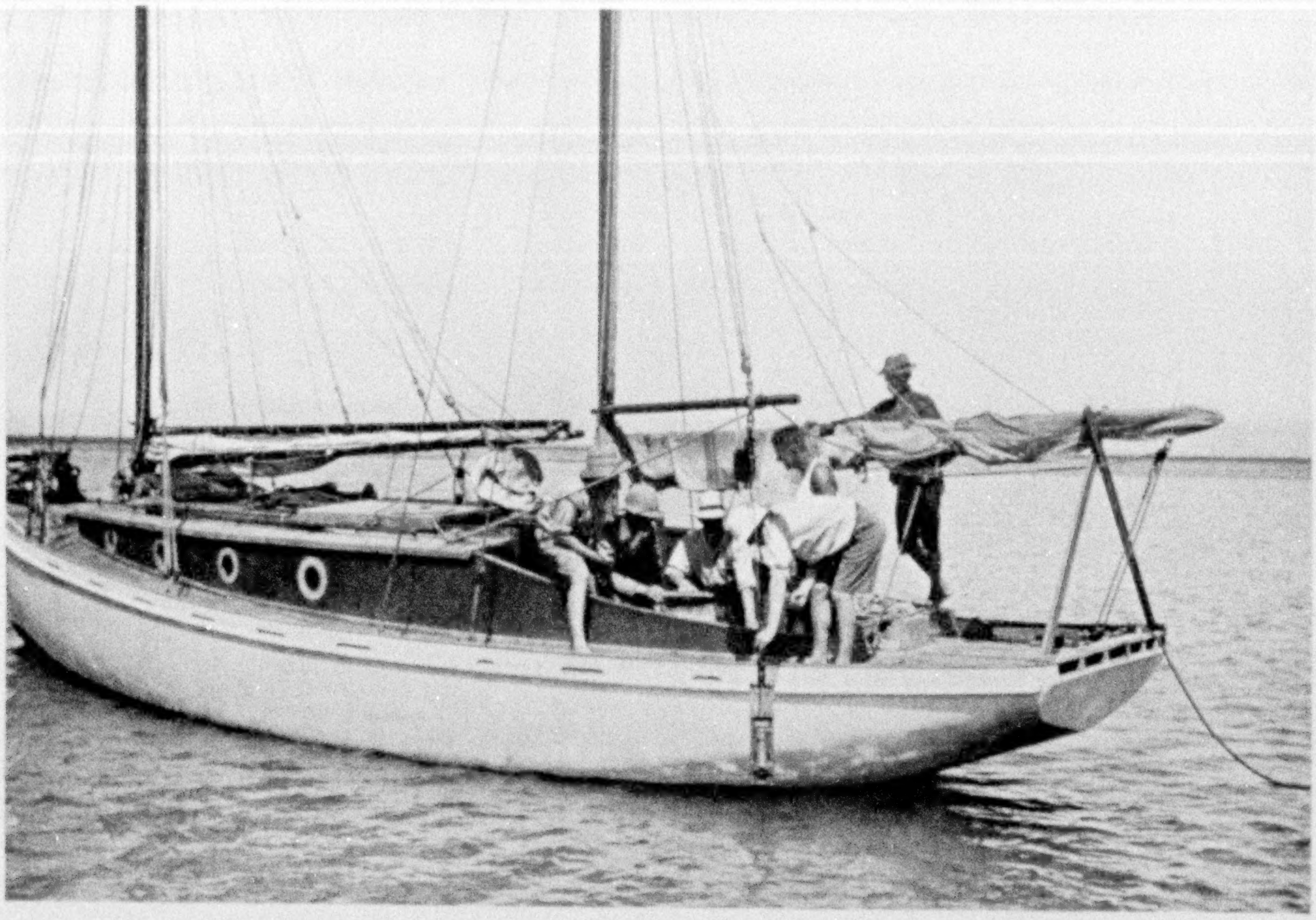
THE WORLD'S BIGGEST CLAMS

Giant clams (*Tridacna gigas*), whose valves are in demand for use as garden ornaments and even home aquaria, rare or lacking on some of the island reefs, are common on many parts of the Outer Barrier. Their size is astonishing, and pearl divers are said to fear them. Tales of tragedy, of divers trapped by Tridacnas, are not baseless. The great valves, agape, may close like a vise on a man's leg or his arm, in deep water. Tridacna possesses immense muscular power, and, once gripped by its valves, a limb can hardly be released: the victim thus held drowns!

In the British Museum are two giant-clam-shell valves, one weighing 154 pounds, the other 156. But I have seen even larger specimens in Australia. Many of the huge mollusks, alive among the coral, with valves agape, reveal their gay colors and the lovely mantles with the "jewels" along their edges.

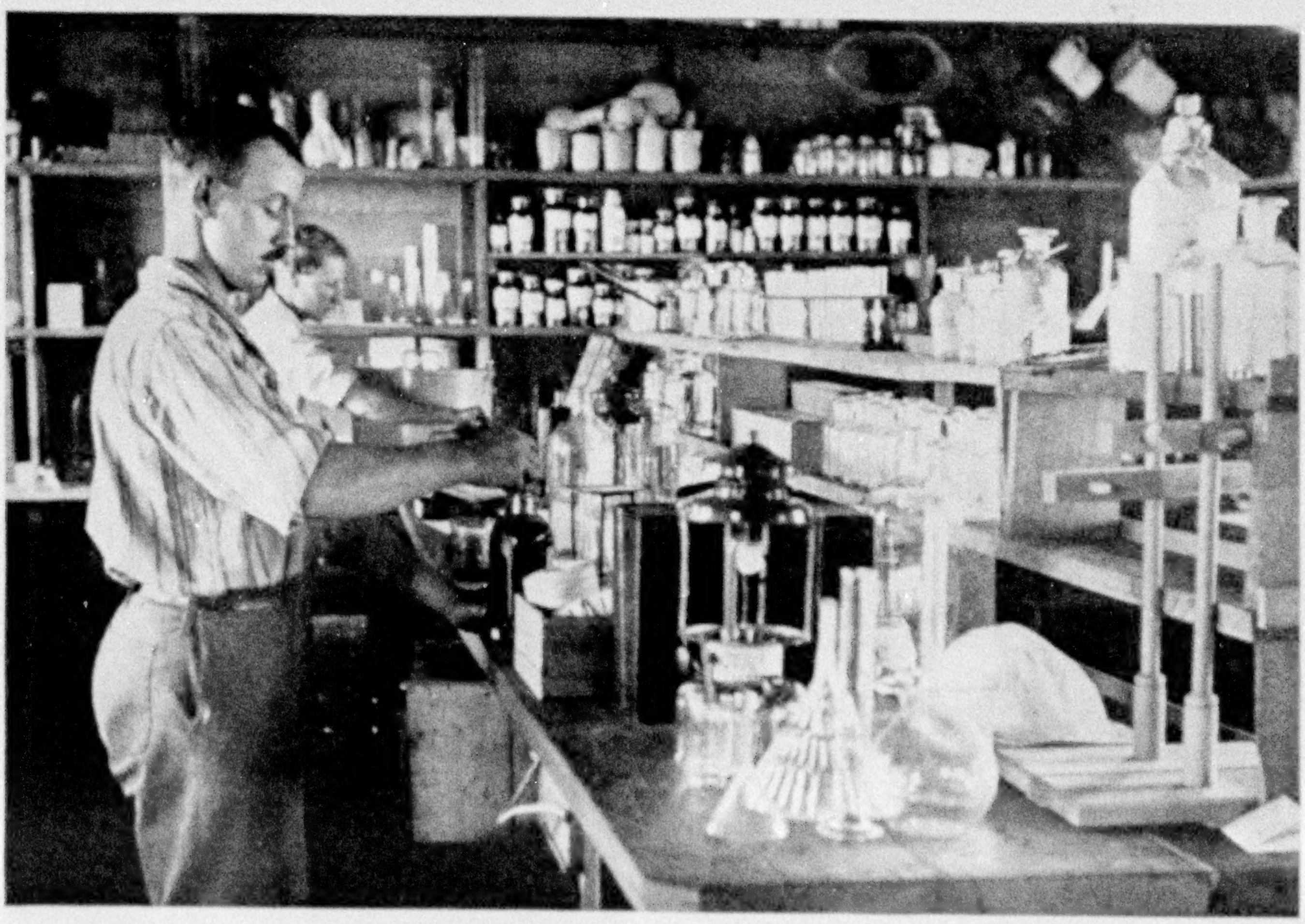
Sea slugs, the bêche de mer of commerce, are gathered from the reefs in vast numbers by Japanese and aboriginal "fishers" chiefly. The toll has been too heavy at some of the isles, where now commercial "slugs" are scarce. But the species that make no appeal to the Chinese epicure continue to flourish. At Low Islets, for instance, we saw the nonedibles in thousands, crawling in the shallow-water pools and channels at low tide, often camouflaged in sand: "sand sausages" they have been termed, and they look it! (P. 363.)

The "prickly fish" is of blackish-green color and has a plastic body. Another species, about 3 feet in length, is black and dwells among dead coral. Most intriguing of all the sea slugs, though, is



SEEKING A KEY TO THE MYSTERY OF THE SEA

For chemical analyses and study, samples of sea water were taken at various depths.



Photographs by Charles Barrett

AN ISLAND LABORATORY

The chemist of the Great Barrier Reef Expedition pursues his analysis of sea water.

Photograph by William Jackson

TURTLE NESTS ARE LOCATED BY PROBING THE SAND

Though the artful green turtle tries to conceal her nest, the tracks she makes to it and to the counterfeit ones over the sand are unmistakable, unless the wind has obliterated them. The blacks probe all likely spots with their sticks or spears, and soon locate the right pit (see, also, text, page 374).

Synapta, which grows to two yards in length, and by the novice is mistaken for a serpent. Its body *is* snakelike, and, crawling over the weedy flats, it looks reptilian with its variegated colors, yellows and browns and dull-green.

SEA FLOWERS FLOURISH ON THE BARRIER

Sea urchins, with long, needle-pointed spines that are poisonous, are a menace to the eager naturalist. The points are brittle and break at a touch, causing festering sores in careless fingers. The needle-spined sea urchin bears spines a foot in length.

Sea anemones, no less than living corals, are "flowers" of reef and lagoon. And the Great Barrier is rich in large and lovely species. Emerald-green, scarlet, golden-brown, and electric-blue are among anemone colors. On Low Island I saw the giant *Stoichactis,* specimens measuring more than a foot in diameter and of a brilliant green hue. Prawns and little fishes, exquisitely painted, were messmates of the great anemone. The midgets swam safely amidst tentacles that are charged with stinging proclivities.

The corals' living beauty may not be captured in words.* An hour on a reef at low tide, or a cruise in a boat equipped with a water glass, reveals a new world of loveliness. Or going below, with the diving helmet on, one discovers fresh beauties in familiar things.

Diving in deep water, outside the reefs, is perilous, since great sharks and giant groupers hunt there and are ugly customers. The grouper of this region, a mighty fish and apparently fearless, gives no warning of attack, but charges savagely. He is feared more than the sharks in our seas.

Eels are as plentiful as sea snakes in these tropical seas. Some grow to nearly eight feet in length, big fellows with formidable teeth and ever ready to fight. But the monster reef eel, 20 feet long, no naturalist has seen. Does it exist? Old roamers of the Barrier told W. Saville-Kent about it, and said they would rather face a man-eating shark any day than the giant reef eel.

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*See, also, "First Autochromes from the Ocean Bottom," in the NATIONAL GEOGRAPHIC MAGAZINE for January, 1927.

THE BEACH COMBER OF DUNK ISLAND

When "Confessions of a Beachcomber" was published in 1908 Romance smiled. Here was an authentic book, with all the charm of fiction. The author, a journalist, sick and world-weary, sought peace on an island off the coast of Queensland. Hope was a dying flame when he landed on Dunk Island. But he wakened, after a night of misgivings, to a new life instead of a hopeless dawn.

The self-styled "beach comber" and his wife lived for 25 years on their tropic isle. In his books, E. J. Banfield has told the story of a unique adventure in contentment, of life as it may be lived on a lonely isle, even in an age of airplanes and automobiles. My friend was a Nature lover and a scholar who could turn his hand to any needful task. His wife was a worthy comrade for the naturalist-recluse.

Their idyl ended tragically in 1923. Banfield died, and his widow, for several days, was alone in her grief. Then, waving a distress signal from the beach, she was seen from a passing steamer. Sailors went ashore—and a cairn on Dunk Island marks the grave of the man who loved wild Nature and the simple life, and marched to the music which he heard.

Dunk is the dream island, with its lovely beaches, its jungle-clad heights, its coral reef and its birds. The "beach comber" has written lovingly of the living things about him; of crabs and fishes and corals; of sunbirds that are jewels on the wing; of mound-making scrub fowls and the swiftlets that nest in a secret cave which few white men have visited. He took all Nature for his province, and on his island the gun was tabu: it was sanctuary for wild things large and small.

My days with the beach comber were golden, though on many rain fell drenchingly. He was rich in knowledge of the Great Barrier Reef, knew all the legends and true stories, and was friends with the

Photograph by Charles Barrett

A FOE OF THE FRUIT GROWER

"Flying foxes" is the popular title for fruit bats. They have become so great a pest in Queensland and New South Wales that Science is seeking a method of wholesale destruction. They form "camps" among fig and other trees; tens of thousands may resort to the same clump of trees.

Photograph by Charles Barrett

WHEN THE TIDE IS LOW

One may ramble for miles over the coral, around some islands of the Great Barrier system.

land and the sea. The bungalow, in its half-wild garden, was a tropical home where welcome seemed to smile from every corner.

Visitors dropped in from a lugger sheltering in the bay, from pleasure boats and from other craft. Invited, folk came from the mainland, not far away, or ended at Dunk Island journeys of a thousand miles. All sorts and conditions of men visited the isle, but none was more welcome than the naturalist, naming birds without a gun.

The romance of the Great Reef shines like a star in Banfield's books. He was not a scientist, but men of science learned from him secrets of the coral world. He made discoveries and gave them to his friends.

THE DYING RACE

Dunk Island was inhabited originally by blacks. There were tribes on the mainland, still in the Stone Age state, not so many years before Australia became a nation. Other isles of the Barrier Reef region were aboriginal territory. Progress has changed all that. Where the black man made fire by friction, sugar cane or cotton now grows; banana plants occupy hill slopes where cannibals camped, and the cassowary's haunts become narrower every year.

Still, there are aborigines in Queensland, untouched by civilization. They belong to the far-northern region and little-known western country. Primitive man has a place there; he has gone from the eastern isles.

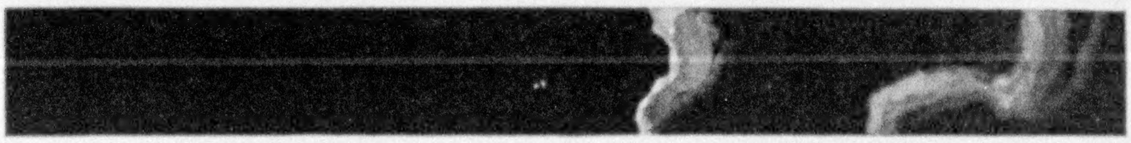
The mainland, whose sea guardian is the Great Barrier Reef, lures to its forests and streams many who go north for coral islanding. It is a tropical wonderland, with rain forest rich in birds and splendid butterflies, in orchids and palms and ferns.

Crocodiles bask on the mud banks of north Queensland rivers and lurk among the mangroves by the sea. Nature has not yielded all her secrets yet, in this country of the cassowary and tree-climbing kangaroos. But the Great Barrier guards a hundred secrets, where the mainland has one. Is it not a wonder of the world?

YOUR CHOICE

Every soup you ever want, at its delicious best!

- ASPARAGUS
- BEAN
- BEEF
- BOUILLON
- CELERY
- CHICKEN
- CHICKEN-GUMBO (OKRA)
- CLAM CHOWDER
- CONSOMMÉ
- JULIENNE
- MOCK TURTLE
- MULLIGATAWNY
- MUTTON
- OX TAIL
- PEA
- PEPPER POT
- PRINTANIER
- TOMATO
- VEGETABLE
- VEGETABLE-BEEF
- VERMICELLI-TOMATO



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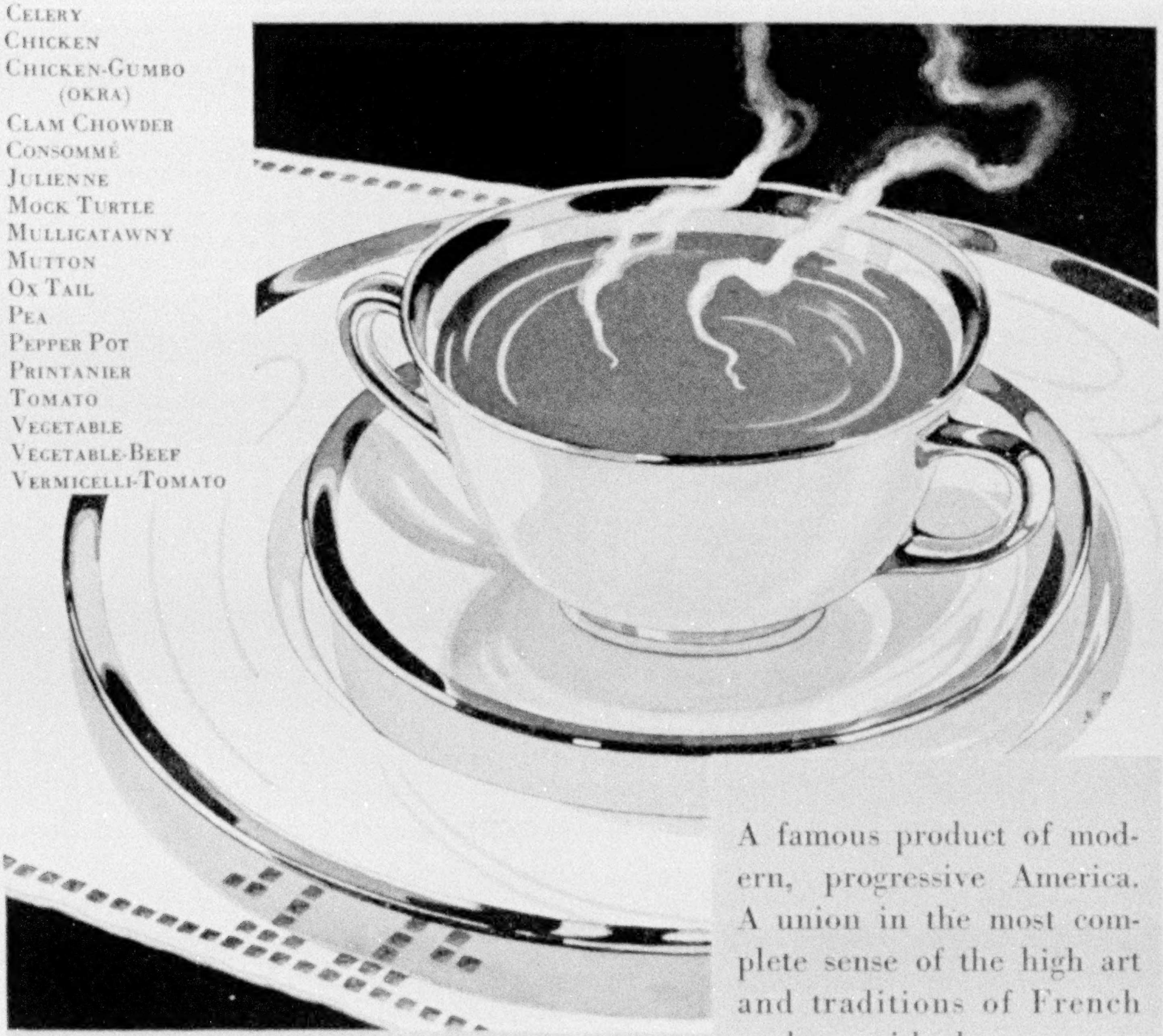

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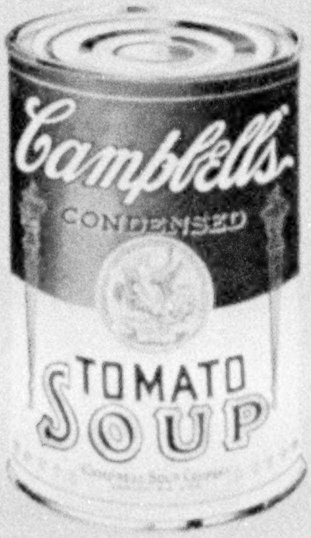

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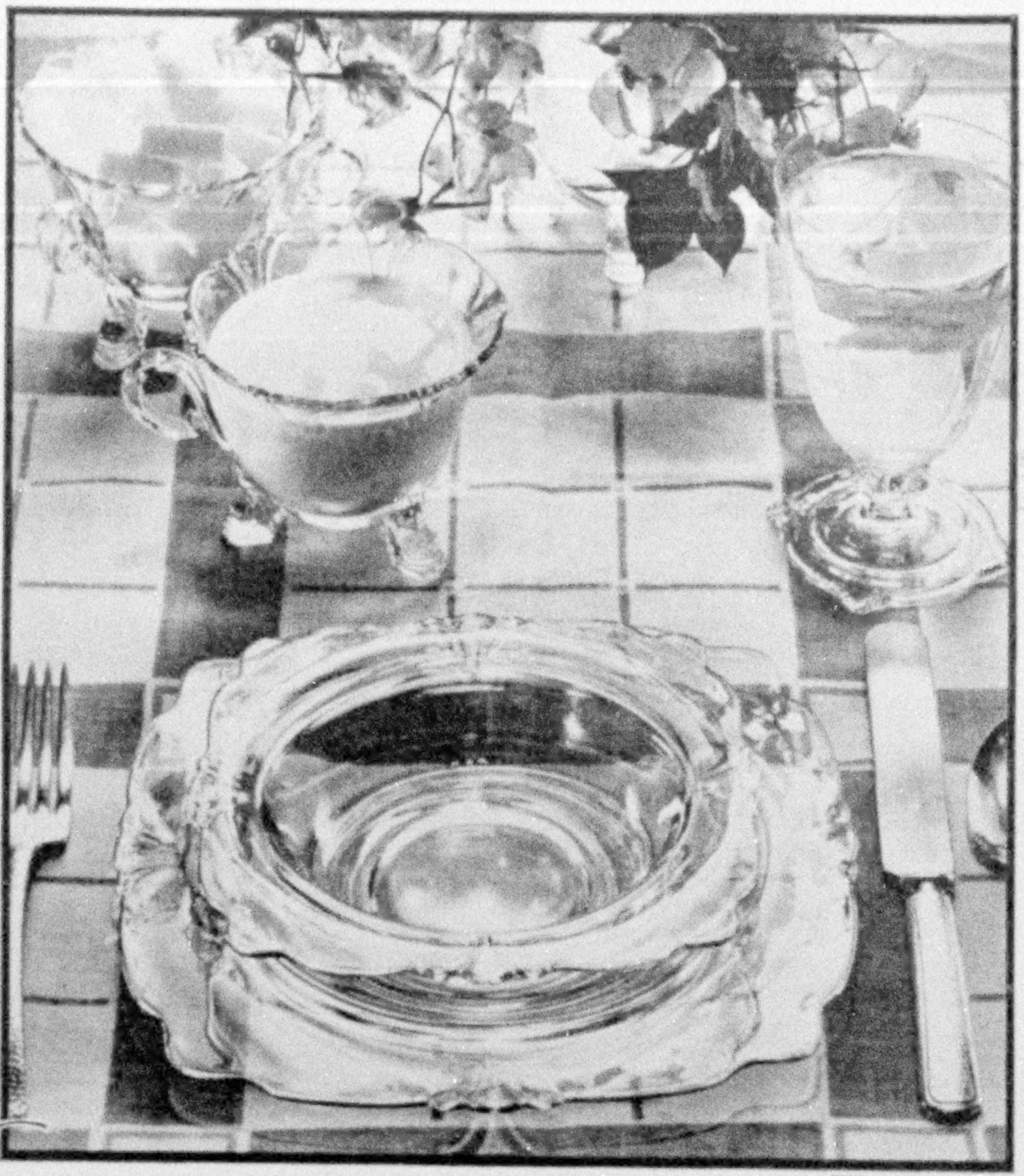

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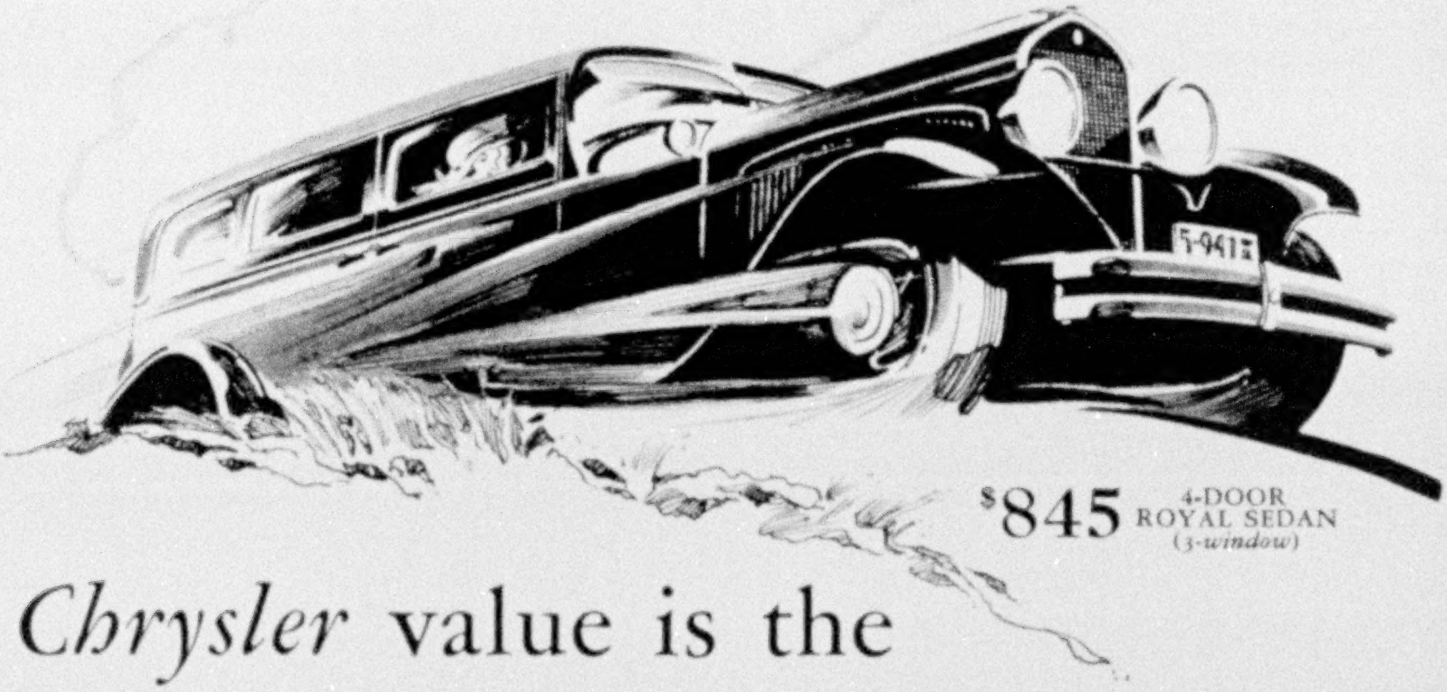

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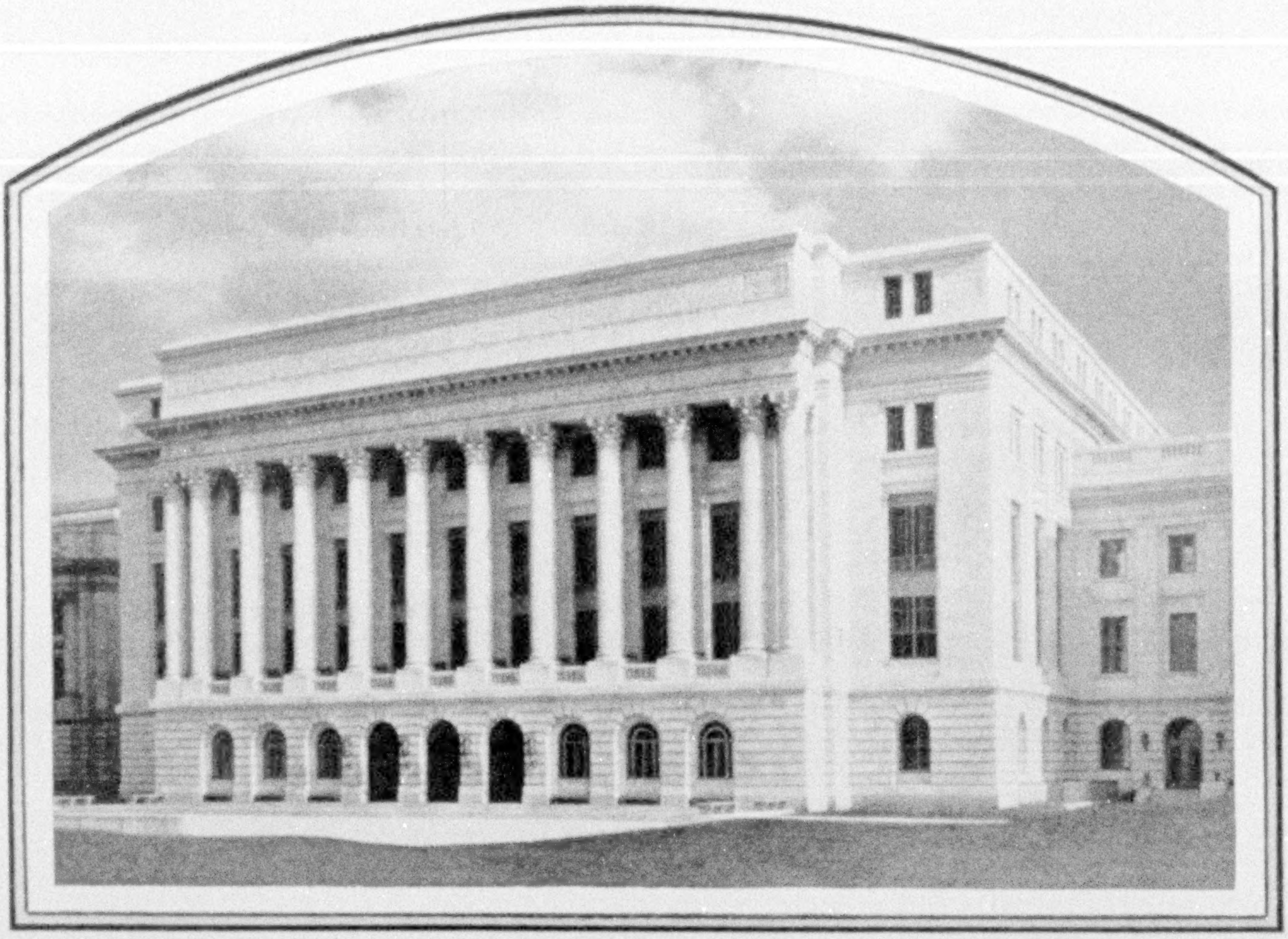

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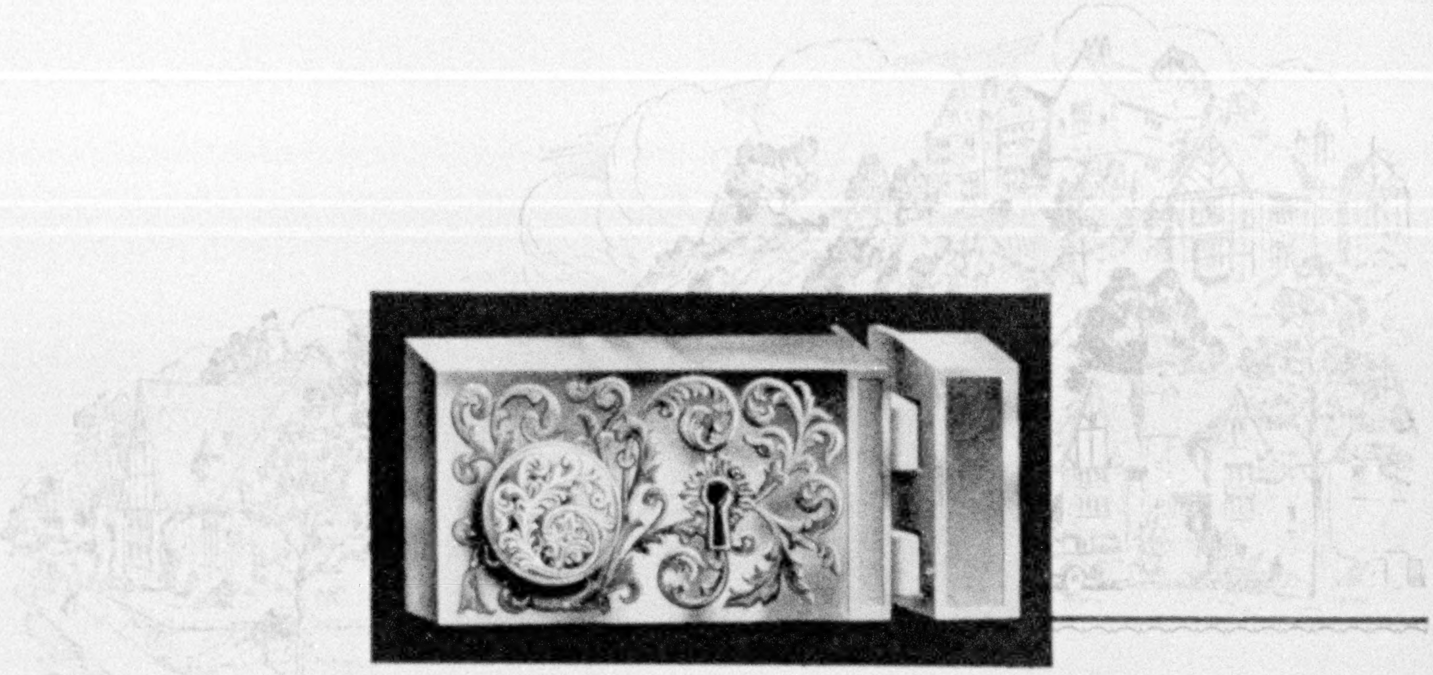

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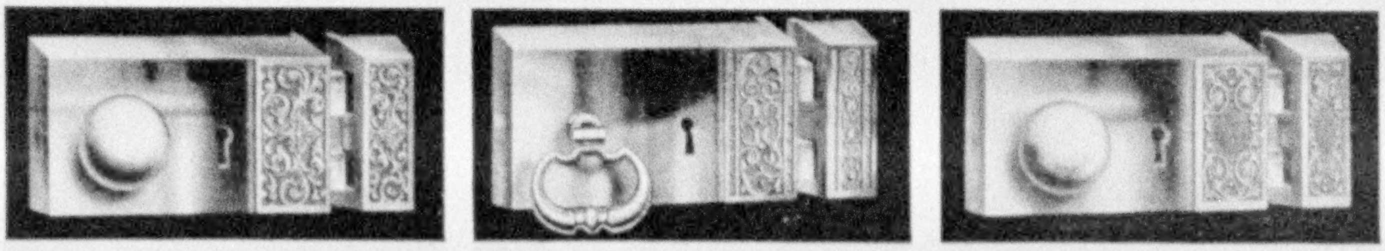
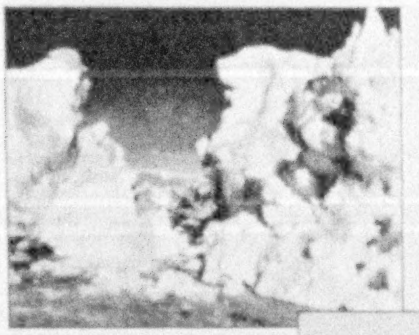


For the Architect's convenience RUSSWIN Hardware is illustrated and described in Sweet's catalogue, pages C-3137—C-3216.



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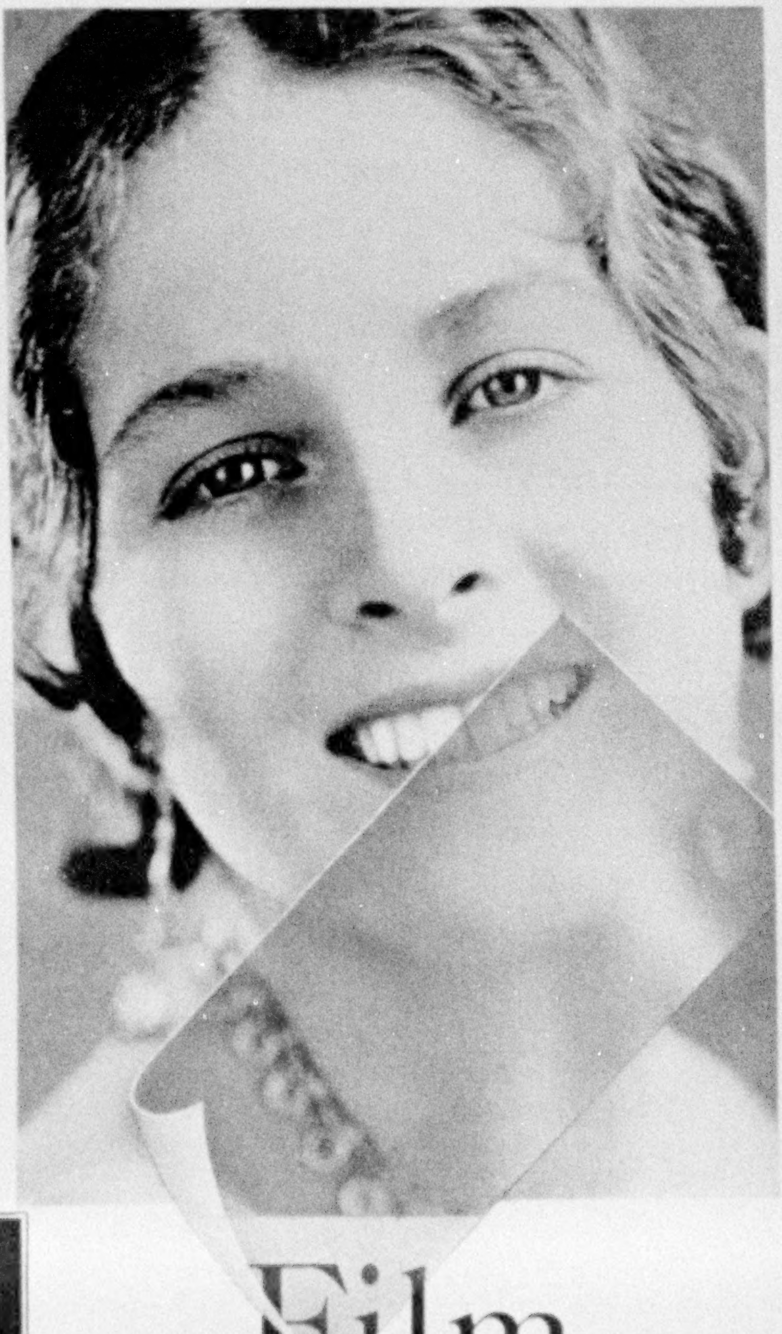

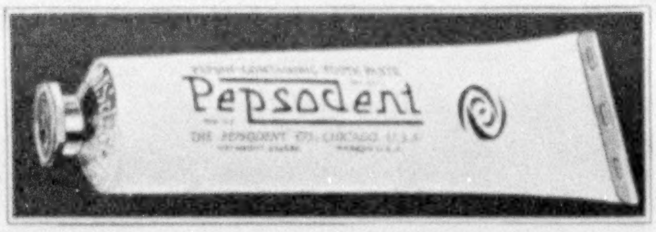

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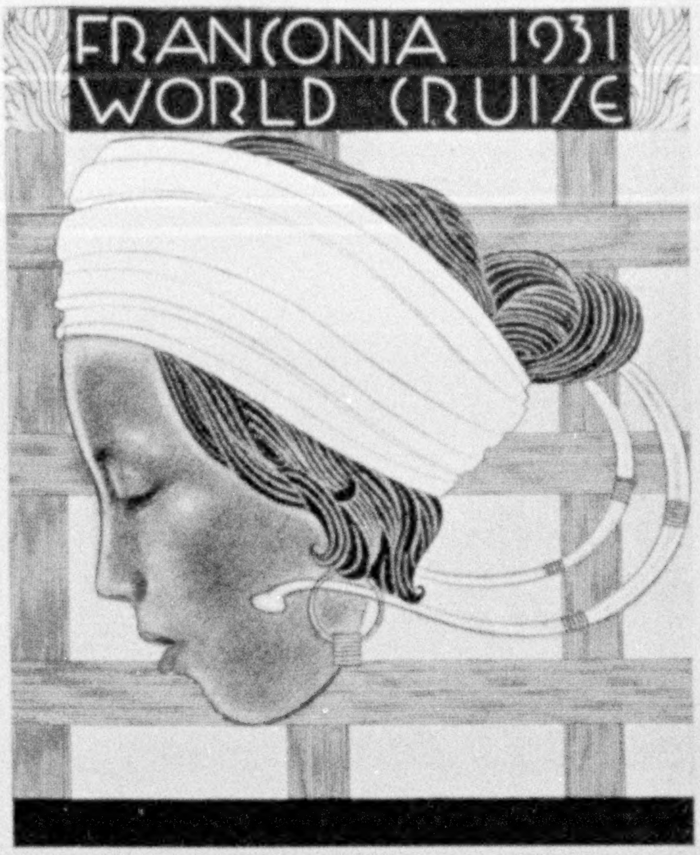

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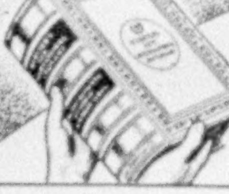

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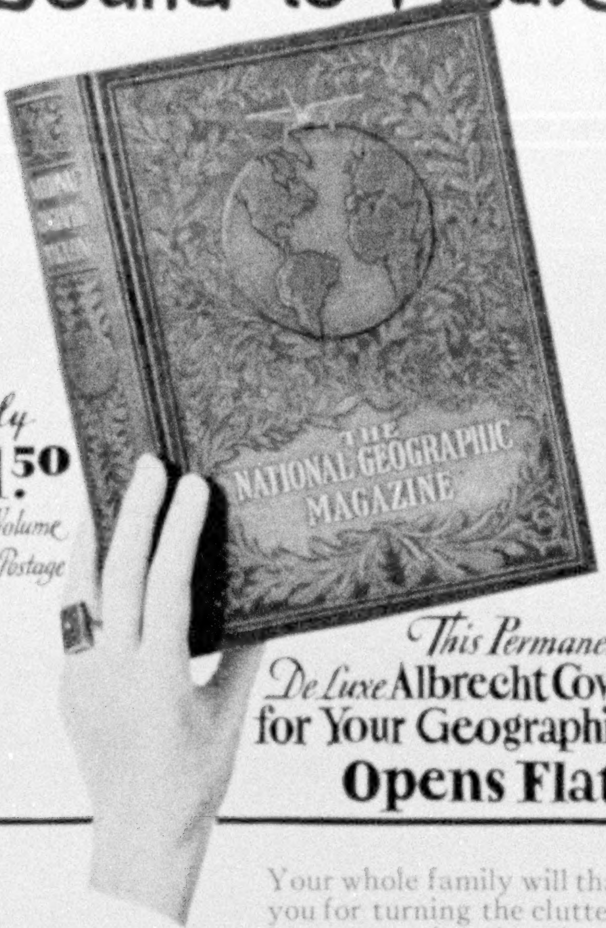

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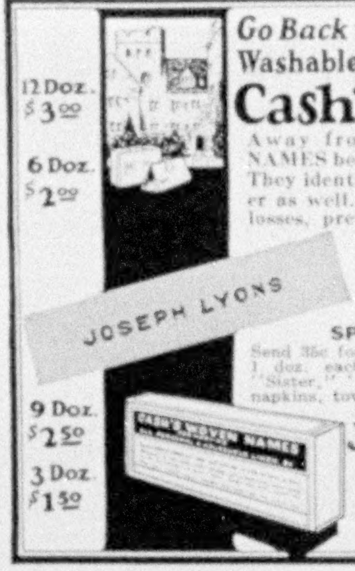
12 Doz. $3.00
6 Doz. $2.00
9 Doz. $2.50
3 Doz. $1.50

Go Back to School with all Washables Marked with –

Cash's Names

Away from home CASH'S NAMES become doubly valuable. They identify clothing and owner as well. They save laundry losses, prevent arguments as to ownership and mark one's individuality. Neat, easy to apply, permanent, economical.

SPECIAL OFFER

Send 35c for Cash's "Family Set"—1 doz. each "Mother," "Father," "Sister," "Brother." Sew them on napkins, towels, etc., and avoid confusion.

J.&J. Cash, Inc.

530th St., So. Norwalk, Conn., or
6409 So. Gramercy Place, Los Angeles, Cal.,
or 130 Gray St., Belleville, Ont.

Use Moore Push-less Hangers for Pictures

10c Packets Everywhere

They cling snugly to walls and insure safety for framed pictures, mirrors, etc. Four sizes. Easy to attach to walls. For light-weight wall decorations, use Moore Push-Pins.

Moore Push-Pin Co., Philadelphia

DUES

Annual membership in U. S., $3.00; annual membership abroad, $4.00; Canada, $3.50; life membership, $100. Please make remittances payable to the National Geographic Society, and if at a distance remit by New York draft, postal or express order.

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IN THE

NATIONAL GEOGRAPHIC SOCIETY

The Membership Fee, Which is for the Calendar Year, Includes Subscription to the National Geographic Magazine

PLEASE DETACH AND FILL IN BLANK BELOW AND SEND TO THE SECRETARY

....193

To the Secretary, National Geographic Society,
Sixteenth and M Streets Northwest, Washington, D. C.:

I nominate ....

Occupation ....
(This information is important for the records.)

Address ....

....*for membership in the Society.*

....

....
Name and Address of Nominating Member

9-30

The Improved QUIET SI-WEL-CLO

TEPECO

OUR
GUARANTEE

We make but one grade of ware—the best that can be produced—and sell it at reasonable prices. We sell no seconds or culls. Our ware is guaranteed to be equal in quality and durability to any sanitary ware made in the world. The Te-pe-co trade mark is found on all goods manufactured by us and is your guarantee that you have received that for which you have paid.

Hygienic ⸙ ⸙ Sanitary ⸙ ⸙ Quiet

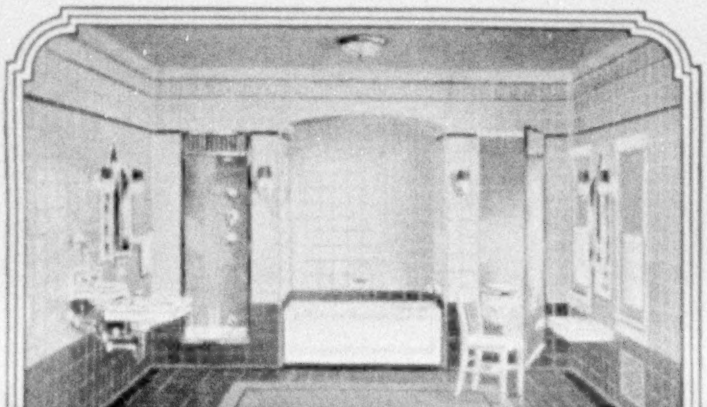
To the quiet operation of the Si-wel-clo Closet has been added a change in design which has brought favorable comment from medical authorities. The decided dip in the rim elevates the front and rear of the bowl opening, minimizing the possibility of soiling.

The Improved Si-wel-clo is unquestionably the greatest advance in water closet construction of recent years. It is the most comfortable, hygienic, sanitary, clean and quiet closet that has ever been devised.

The Si-wel-clo is but one item of Te-pe-co All-Clay Bathroom Fixtures. Equip your entire bathroom with this glistening white, solid and substantial china and porcelain. A wise investment—a beautiful one.

Bathrooms of Character

By all means send 10 cents for the new edition of our plan book No. V-4. "Bathrooms of Character"



THE TRENTON POTTERIES CO.
Trenton, New Jersey, U. S. A.

National Exhibit Rooms
101 Park Ave., New York City, Entrance on 41st Street
Sales Offices in Philadelphia, Boston and San Francisco
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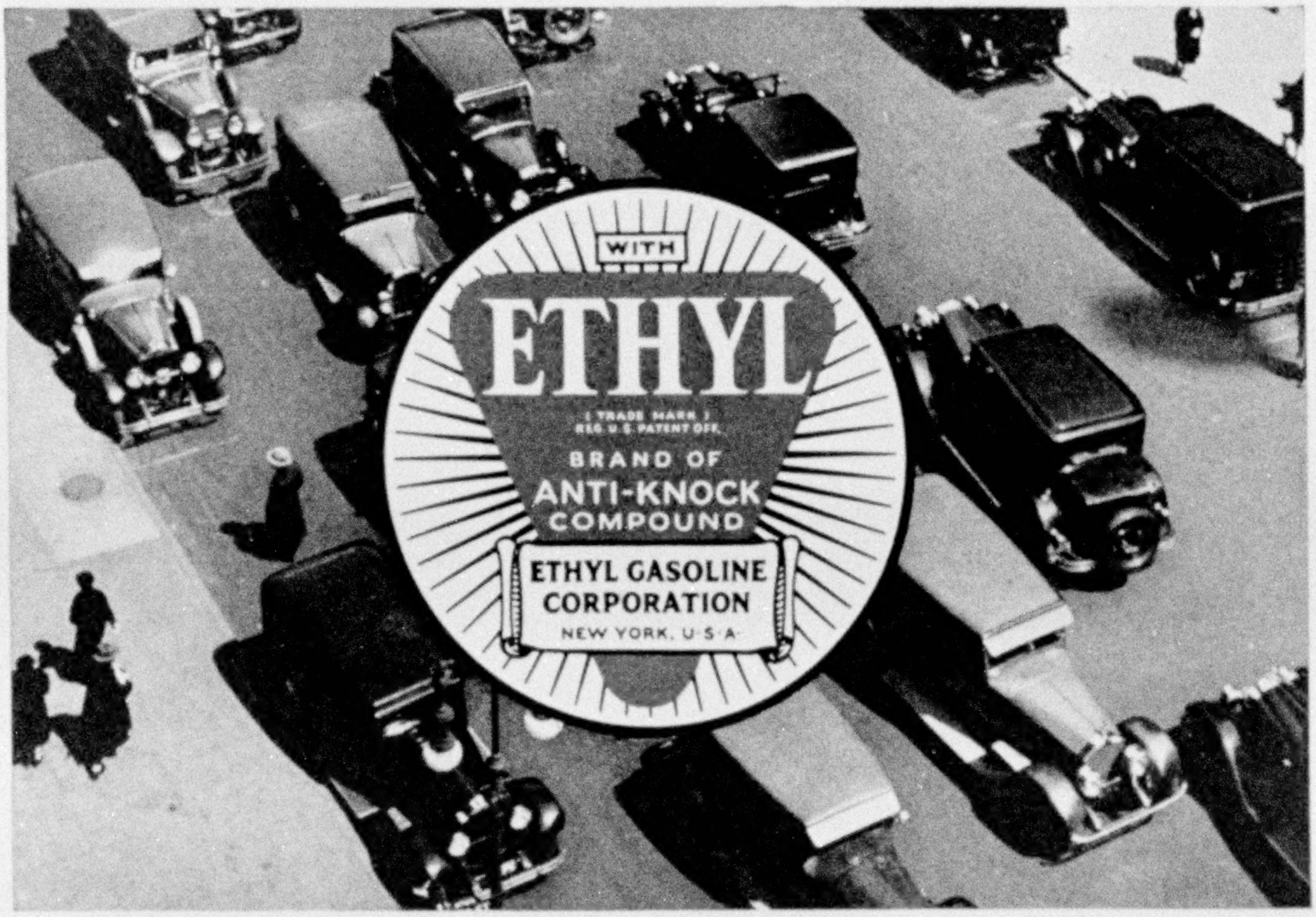
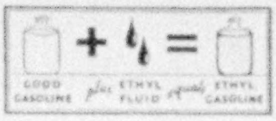
TE-PE-CO
ALL-CLAY PLUMBING FIXTURES

More people (*shrewd ones, too*) buying Ethyl *than any other gasoline*


WITH
ETHYL
(TRADE MARK) REG. U.S. PATENT OFF.
BRAND OF
ANTI-KNOCK
COMPOUND
ETHYL GASOLINE
CORPORATION
NEW YORK, U.S.A.

ETHYL Gasoline has become the biggest-selling motor fuel in America. Checks made on representative highways throughout the country show that about one pump in five now bears the Ethyl emblem. Stop at *any* of them. All Ethyl Gasoline is good.

Each of the 75 oil refining companies now mixing and selling Ethyl Gasoline has agreed to maintain fixed standards. The base gasoline must meet Ethyl standards of quality and volatility; then to this, enough Ethyl fluid is added to bring the mixture up to the requirements for Ethyl Gasoline.


GOOD GASOLINE
plus
ETHYL FLUID
equals
ETHYL GASOLINE

Knocks out that "knock"

Whatever car you drive, you will find Ethyl Gasoline improves performance. It gives greater power, quicker pick-up, and smoother, more efficient motor performance.

Any car runs better on Ethyl.

Ethyl Gasoline Corporation, Chrysler Building, New York City.

The active ingredient used in Ethyl fluid is lead.

© E. G. C. 1930

ETHYL GASOLINE

Surprisingly increased efficiency in the Two New Hoovers

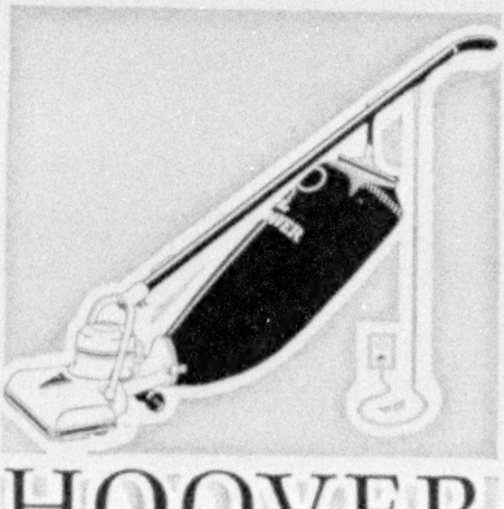
Your Hoover dealer will be glad to show you these two remarkable new Hoover models, offering greatly increased dirt-removing ability and selling at the same price as former models.

What if you polished your nails but did not clean beneath them?

YOU wouldn't think of having such a standard of cleanliness for your hands! But, quite unrealizing, you may have just such a standard for your floor coverings.

When you clean by broom or suction, you are leaving untouched the dirt beneath the surface. Nothing will get out this dirt except beating. There is only one effective way to beat it out—with a Hoover, whose exclusive cleaning principle, Positive Agitation, is especially designed for shaking out the destructive embedded grit.

So effectively does The Hoover remove this *underneath* dirt that it gets out more *dirt per minute* than any other cleaner, giving more thorough cleanliness in less time and with less expenditure of human energy.



HOOVER

IT BEATS..AS IT SWEEPS..AS IT CLEANS
ON A CUSHION OF AIR

It also gathers up the ugly thread and lint, brightens the rug colors and lifts and smooths the nap, thus giving new beauty to floor coverings by its scientific care. Ask our Hoover dealer for a free trial or home demonstration of The Hoover and its efficient dusting tools. Two Hoover models, only $6.25 down; balance monthly. Liberal allowance for your old cleaner.

THE HOOVER COMPANY
North Canton, Ohio
The oldest and largest maker of electric cleaners
The Hoover is also made in Canada, at Hamilton, Ontario

MORE DIRT
DPM
PER MINUTE

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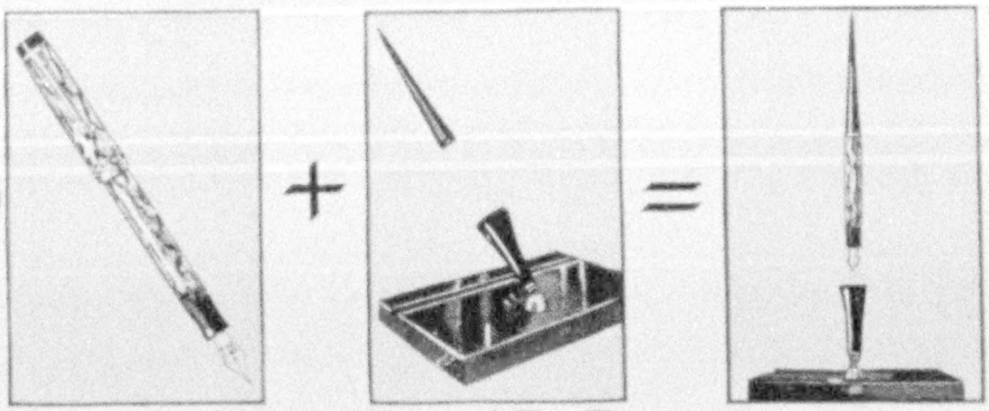
PRESS OF JUDD & DETWEILER, INC.
WASHINGTON, D. C.

The First Lesson for the Fall Term of School



Pocket Duofold plus base and Free Taper

Equals Complete Desk Set for Home Study

1—Parker Pocket Duofold being convertible—
2—saves the Price of a Desk Pen—
3—which Pays for the Desk Base!

Every Parker Duofold is convertible—a combination pocket and desk Pen both, at no extra charge.

Choose Parker Duofold and you virtually get two pens for the price of one.

Yet you have only one to fill. And you have your accustomed point *wherever* you are.

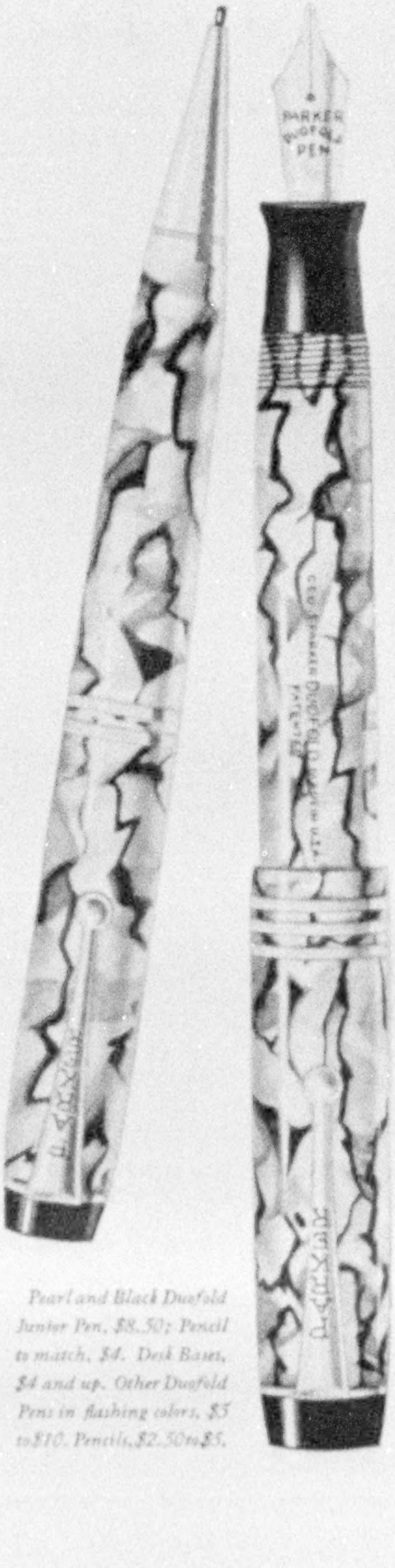
When you're on the go, it wears its trim, streamlined cap, with Parker's patented clip that holds the Pen low and unexposed in your pocket.

On your desk, it rests in Parker's ball and socket base. And with it comes the tapered end for the pen (once $1 extra), now included free.

Attaching the taper converts the Duofold into a Desk Set Pen. Removing it restores the Pen to a pocket model. Changing back and forth doesn't take ten seconds. *And taking your pen from your desk when you go insures your having it when you return.*

Paying more won't get you a thing—but will deprive you of this double value. For only the Parker offers this. And this in a Pen that holds 17.4% more ink than average, size for size, and is *Guaranteed for Life!*

The Parker Pen Company, Janesville, Wisconsin



Pearl and Black Duofold Junior Pen, $8.50; Pencil to match, $4. Desk Bases, $4 and up. Other Duofold Pens in flashing colors, $5 to $10. Pencils, $2.50 to $5.

Parker Duofold

PEN GUARANTEED FOR LIFE